

# Leak Detection – Tanks

NCDENR  
Division of Waste Management  
Underground Storage Tank Section

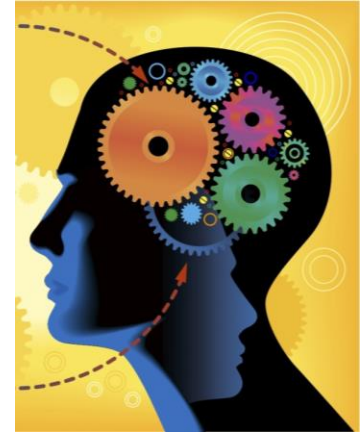
# Why conduct Leak Detection?

- ▶ Discover a release BEFORE a major contamination occurs
- ▶ Required for *regulated systems*:

## EXCEPTIONS:

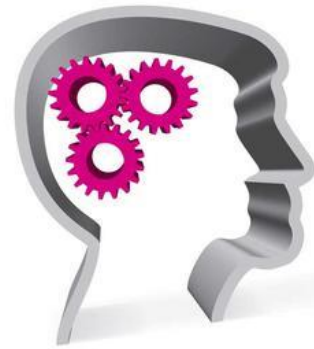
- Temporarily closed tanks
- Emergency generator tanks installed before 11/1/07

# Leak Detection Requirements



- ▶ Conducted **monthly**
- ▶ Detects a release from ***any*** portion of the tank
- ▶ Manufacturer's instructions dictate installation, calibration, operation and maintenance

# Leak Detection Requirements



## ▶ Third Party Certification:

documentation that your leak detection method works for your UST system

### **All Methods Have Limitations**

- e.g. – tank size, minimum fuel levels, throughput, “down time”

# Most common Leak Detection Methods



A

**Statistical  
Inventory  
Reconciliation  
(SIR)**



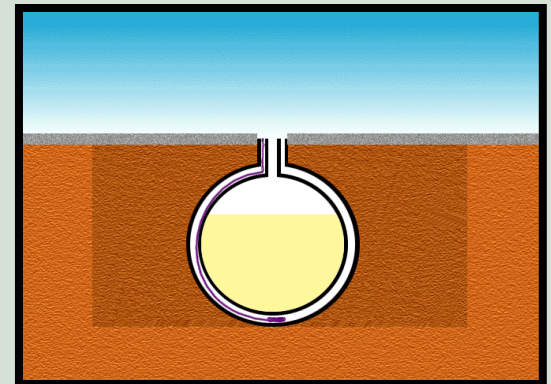
B

**Automatic  
Tank Gauging  
(ATG) Systems**



C

**Secondary  
Containment  
with  
Interstitial  
Monitoring**



# #10 on checklist

## Leak Detection

### General

#### 10 – Tank – Primary leak detection method

- **SIR** (Statistical Inventory Reconciliation)
- **ATG**  
(Automatic Tank Gauge)
- **IM**  
(Interstitial Monitoring)
- **N/A**  
(Generator tank)
- **Unknown?**

# Tank Leak Detection

Tank Corrosion Protection	Tank Leak Detection 10	Piping Corrosion Protection			Piping Leak Detection – (circle one)		
		Tank end	Main Run	Dispenser end	Suction	Pressurized	Pressurized
Method	Method	Method	Method	Method	Method (circle one)  European  American/ Standard	Method (circle one)  ELLD  MLLD	Method (circle one)  LTT SIR ELLD IM
Testing Frequency	Testing Frequency	Testing Frequency	Testing Frequency	Testing Frequency	Testing Frequency	Testing Frequency	Testing Frequency
Documentation	Documentation	Documentation	Documentation	Documentation	Documentation	Documentation	Documentation
Next date	Next date	Next date	Next date	Next date	Next date	Next date	Next date



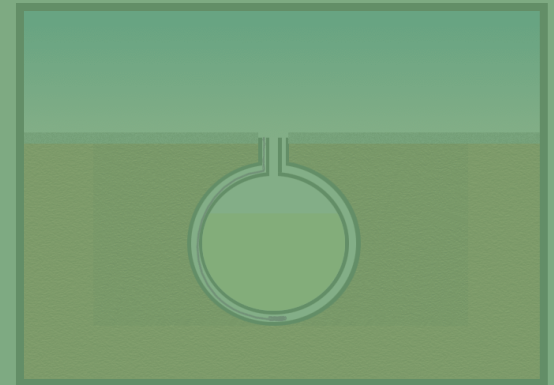
# Most Common Leak Detection Methods



**A**  
**Statistical**  
**Inventory**  
**Reconciliation**  
**(SIR)**

**Automatic**  
**Tank Gauging**  
**(ATG) Systems**

**Secondary**  
**Containment**  
**with**  
**Interstitial**  
**Monitoring**





# A. SIR

United States  
Environmental Protection  
Agency

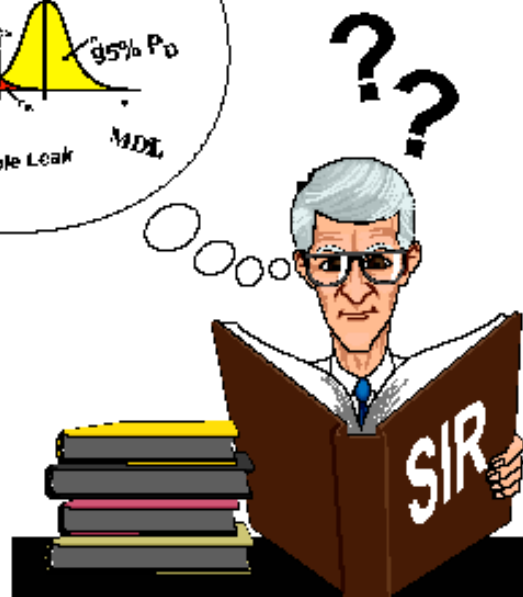
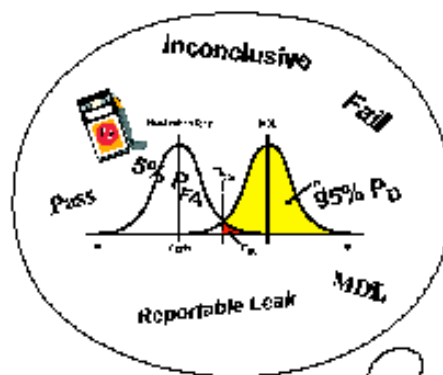
Solid Waste And  
Emergency Response  
5403W

EPA 510-B-95-009  
September 1995



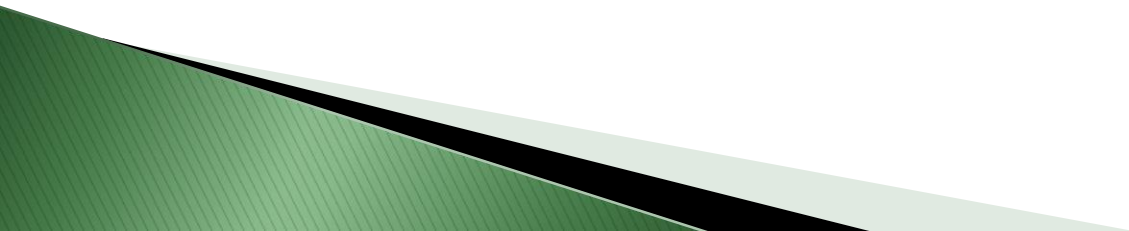
## Introduction To Statistical Inventory Reconciliation

For Underground Storage Tanks



# What is SIR?

The analysis of the inventory, delivery, and dispensing data to detect leaks



# SIR

- ▶ Use stick or ATG console
- ▶ Measure product level daily – to nearest  $1/8^{\text{th}}$  inch
- ▶ Measure water levels monthly



# SIR:



- ▶ Replace **broken** or **unreadable** tank sticks
- ▶ Have **same person** stick tanks daily
- ▶ Stick tanks and read meters at **same time** daily

# SIR Records to Keep

Date / Time		Diesel	Premium	Regular	
6/23	9:10	56 $\frac{3}{8}$	34 $\frac{3}{8}$	52 $\frac{7}{8}$	
6/24	9:15	55 $\frac{7}{8}$	32 $\frac{4}{8}$	51 $\frac{1}{8}$	
6/25	9:00	55 $\frac{1}{8}$	30 $\frac{5}{8}$	50 $\frac{2}{8}$	
6/26	9:05	54 $\frac{3}{8}$	64 $\frac{4}{8}$	48 $\frac{7}{8}$	
6/27	9:10	52 $\frac{6}{8}$	63 $\frac{6}{8}$	47 $\frac{3}{8}$	

- ▶ Product measurement:  
per tank, DAILY, for 12 months
- ▶ Water measurement:  
per tank, MONTHLY, for 12 months

# SIR



- ▶ Use appropriate calibration charts
- ▶ Supply daily inventory to SIR vendor each month
- ▶ Review SIR reports when received from vendor
- ▶ Make sure dispensers calibrated within past 18 months



# SIR Records:

## ► Keep SIR Reports:

per tank, PER MONTH, for 12 months

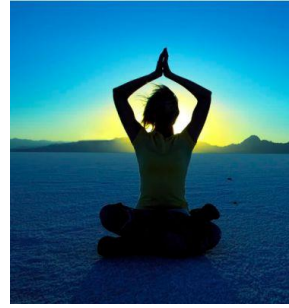
SIR Provider		TotalSIR P.O. Box 2040 Cornelius, NC 28031														
SIR Version		TotalSIR 1.0				<ID:SIR71005>			Site Dir:50142							
Period Covered		05/09				23 usable days per month required.										
TANK				Current Month				04/09		03/09						
Tank ID.	Product	Max. SIR size (gal)	size (gal)	Leak Thres hold (gph)	MDL rate (gph)	Calc. Leak rate (gph)	Water (in)	Pass, Fail, or Inconclusive								
								P	F	I	P	F	I	P	F	I
Unlead	Unlead	45 K	10028	0.200	0.001	0.000		X			X			X		
Premium	Premium	45 K	10028	0.200	0.000	0.000		X			X			X		



# Tank Leak Detection

Tank Corrosion Protection	Tank Leak Detection	Piping Corrosion Protection			Piping Leak Detection – (circle one)		
	10				Suction / Pressurized / Both		
Method	Method	Tank end	Main Run	Dispenser end	Suction	Pressurized	Pressurized
	SIR p.16	Method	Method	Method	Method (circle one)  European  American/ Standard	Method (circle one)  ELLD  MLLD	Method (circle one)  LTT SIR ELLD IM
Testing Frequency	Testing Frequency	Testing Frequency	Testing Frequency	Testing Frequency	Testing Frequency	Testing Frequency	Testing Frequency
	Fuel daily, Water Monthly, Submit to vendor monthly						
Documentation	Documentation	Documentation	Documentation	Documentation	Documentation	Documentation	Documentation
	Calibration charts, daily Fuel, monthly Water, Monthly SIR reports  All for a year						
Next date	Next date --/--/--	Next date	Next date	Next date	Next date	Next date	Next date

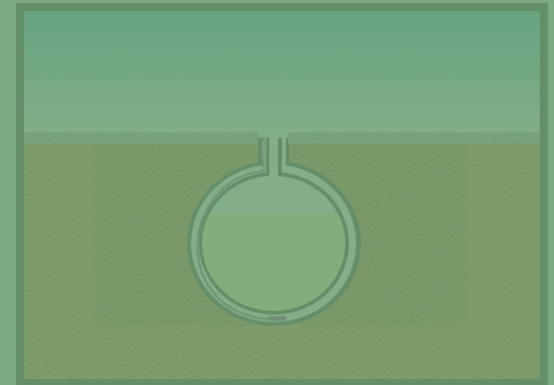
# Most Common Leak Detection Methods



Statistical  
Inventory  
Reconciliation  
(SIR)

B  
Automatic  
Tank Gauging  
Systems  
(ATG)

Secondary  
Containment  
with Interstitial  
Monitoring



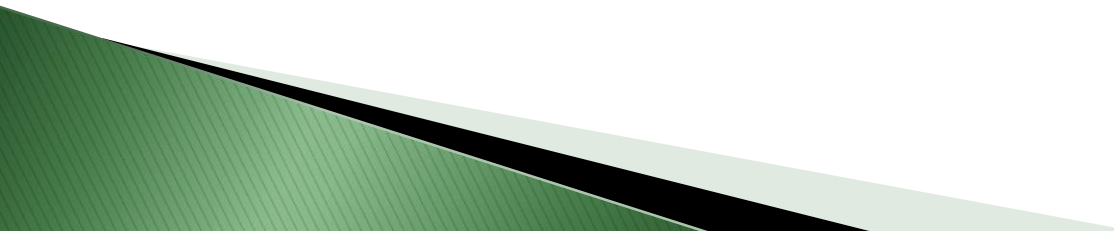
## (2) ATG System

# How do I know if I use an ATG?

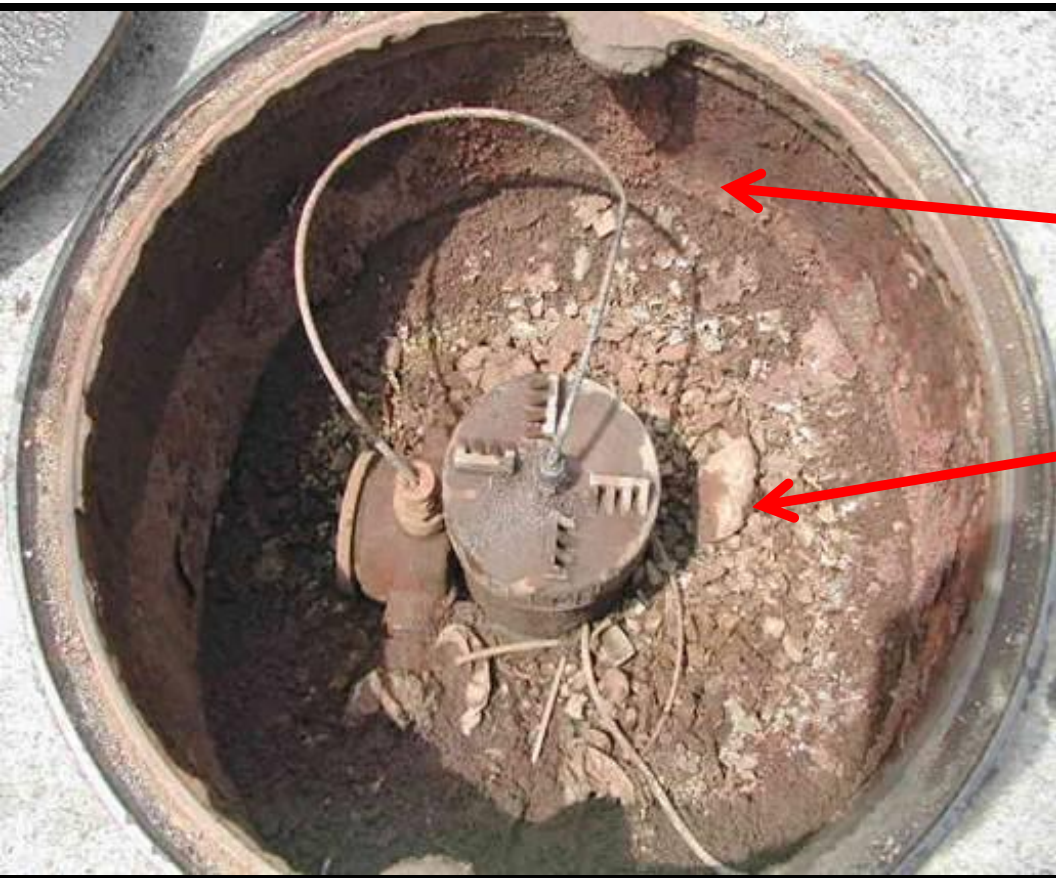
Console located inside facility



# ATG System Description:

- ▶ Probe permanently installed
  - ▶ Wired to monitor
  - ▶ **Product level and temperature recorded**
  - ▶ Calculates changes in product volume
- 

# ATG Probe:



Check if:

- Wires intact
- Capped



# ATG Consoles:



# ATG Console:

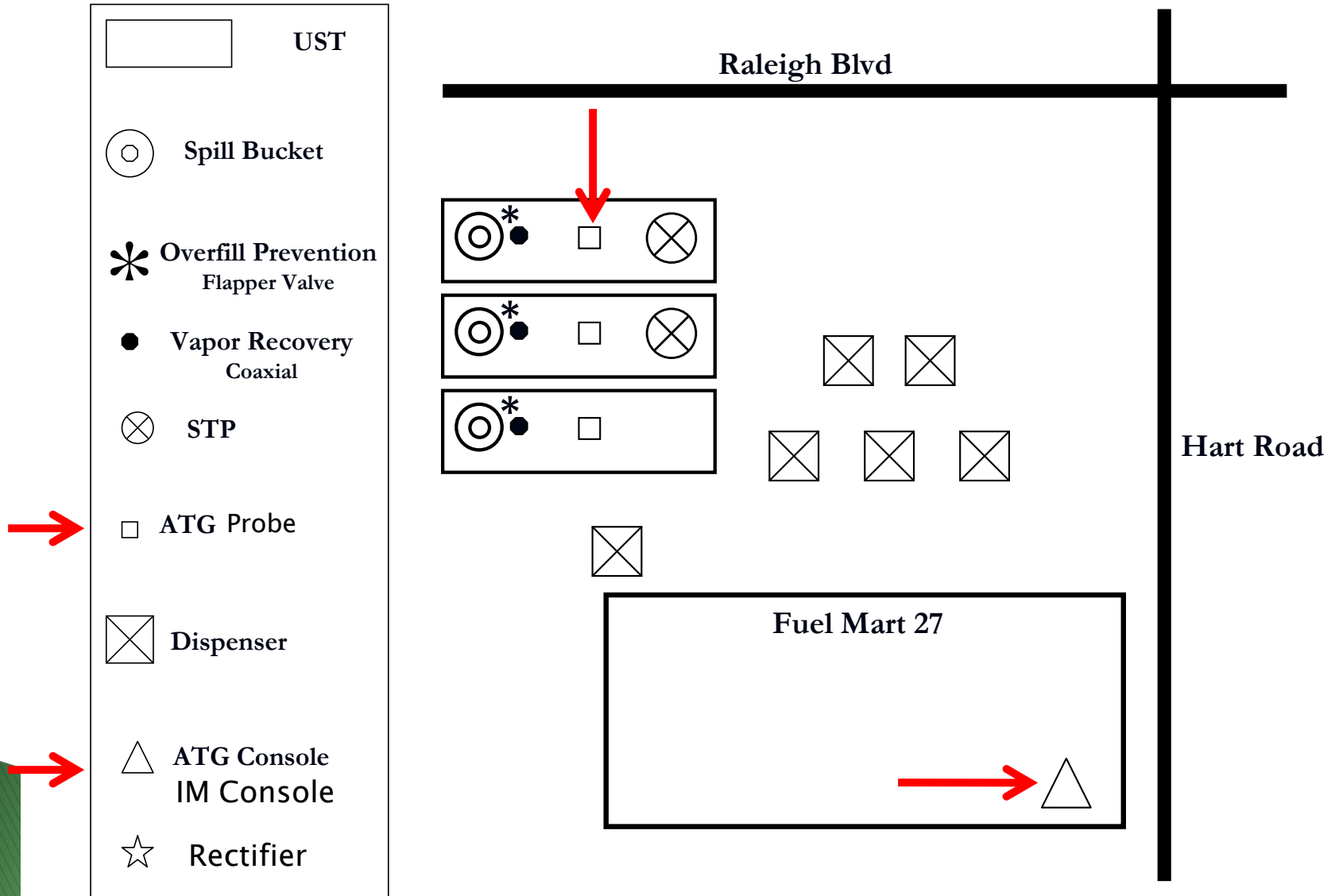


- Present
- Powered on
- No warnings
- No alarms



# UST Site Diagram for:

Fuel Mart 27



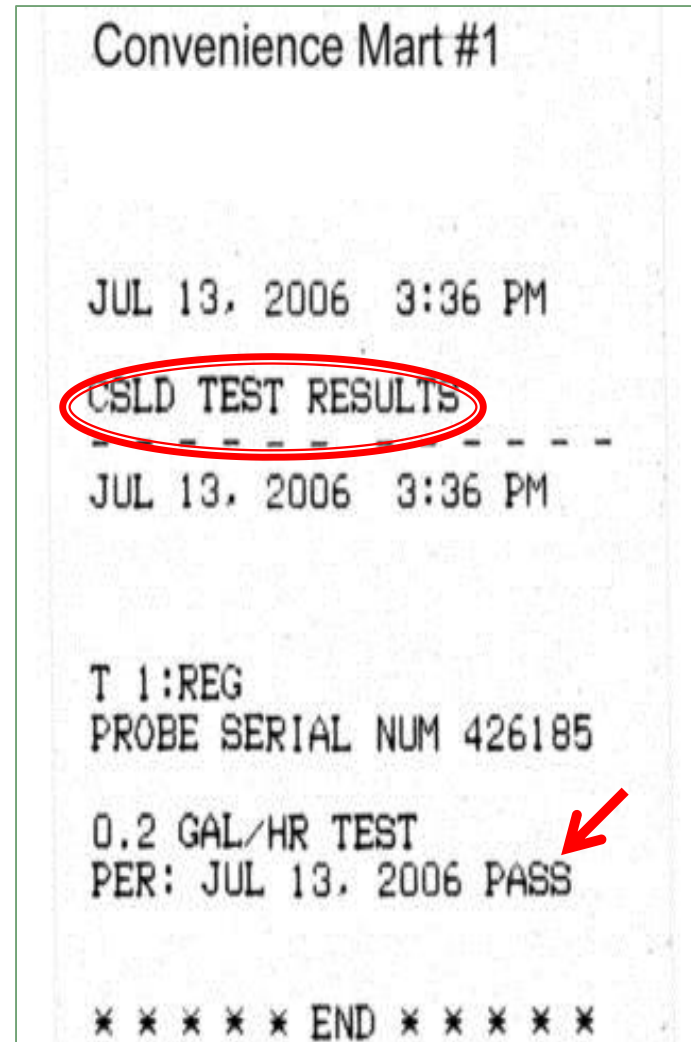
# ATG System Testing



- How much is a 0.2 gph leak?

# ATG System *Testing Modes:*

- ▶ ***Periodic*** (static) test mode:  
Data collected over 'long'  
period of time so tank needs  
“quiet” time
- ▶ ***Continuous*** test mode:  
Data gathered during many  
short periods, (when no  
product is being added to or  
taken from tank)  
e.g., CSLD, SCALD



# ATG System Records:

- Keep: 1 valid, 0.2 gph test result per tank, monthly, for 12 months

<p>OCT 22. 1999 8:00 AM</p> <p>CSLD TEST RESULTS</p> <p>OCT 22. 1999 8:00 AM</p> <p>T 1:DIESEL PROBE SERIAL NUM 408247</p> <p>0.2 GAL/HR TEST PER: OCT 22. 1999 PASS</p> <p>T 2:SUPER PROBE SERIAL NUM 408613</p> <p>0.2 GAL/HR TEST PER: OCT 22. 1999 PASS</p> <p>T 3:REGULAR PROBE SERIAL NUM 408244</p> <p>0.2 GAL/HR TEST PER: OCT 22. 1999 PASS</p>	<p>JAN 22. 2002 11:43 AM</p> <p>LEAK TEST REPORT</p> <p>T 3:REGULAR TANK PROBE SERIAL NUM 240331</p> <p>TEST STARTING TIME: JAN 15, 2002 11:00 PM</p> <p>LEAK TEST RESULTS GROSS TEST PASS</p> <p>***** END *****</p>
--	---



# Record Keeping



# Do I have a well nearby?

## SITING AND SECONDARY CONTAINMENT

Siting And Sec.Containment-General	Tank #1(A1 REGULAR)	Tank #2(A2A PREMIUM)	Tank #3(A2B DIESEL)
UST system upgraded with corrosion protection, spill and overfill before 1/1/91?	No	No	No
UST system and/or piping are located within siting and secondary containment areas?	Yes	No	No

## LEAK DETECTION

General	Tank #1(A1 REGULAR)	Tank #2(A2A PREMIUM)	Tank #3(A2B DIESEL)
DWM notified of leak detection method?	Yes	Yes	Yes
Piping type	Pressurized System	Pressurized System	Pressurized System
Suction Check Type			
Type LLD present.	MLLD	MLLD	MLLD
Tank – Primary leak detection method	Interstitial Monitoring (IM)	Interstitial Monitoring (IM)	Interstitial Monitoring (IM)
Tank - if other, specify			
Tank - Primary LD install	9/10/2014	9/10/2014	9/10/2014

# ATG System Records: VARIATION

If there are drinking water wells nearby:

- Keep: 1 valid 0.2 gph test result per tank, **PER WEEK**, for 12 months

OCT 22, 1999 8:00 AM  
CSLD TEST RESULTS  
-----  
OCT 22, 1999 8:00 AM

T 1:DIESEL  
PROBE SERIAL NUM 408247  
0.2 GAL/HR TEST  
PER: OCT 22, 1999 PASS

T 2:SUPER  
PROBE SERIAL NUM 408613  
0.2 GAL/HR TEST  
PER: OCT 22, 1999 PASS

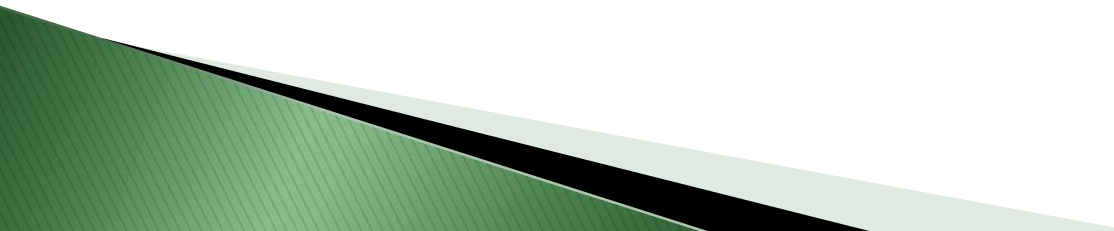
T 3:REGULAR  
PROBE SERIAL NUM 408244  
0.2 GAL/HR TEST  
PER: OCT 22, 1999 PASS

JAN 22, 2002 11:43 AM  
LEAK TEST REPORT  
T 3:REGULAR TANK  
PROBE SERIAL NUM 240331

TEST STARTING TIME:  
JAN 15, 2002 11:00 PM  
LEAK TEST RESULTS  
GROSS TEST PASS  
\*\*\*\*\* END \*\*\*\*\*



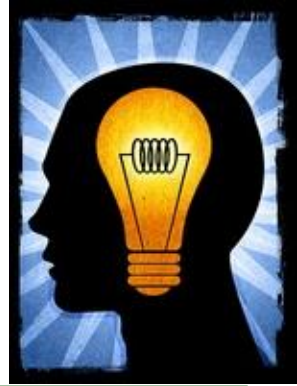
# ATG System – Operation and Maintenance:

- ▶ Know how to access and **print** leak test results
  - ▶ **Check testing printouts routinely**
  - ▶ Follow manufacturer's recommendations for tests and service
  - ▶ Check console after **electrical storms**
  - ▶ Do not ignore **warnings or alarms**
- 

# Leak Detection Tanks

Tank Corrosion Protection	Tank Leak Detection	Piping Corrosion Protection			Piping Leak Detection – (circle one)		
					Suction / Pressurized / Both		
Method	Method	Tank end	Main Run	Dispenser end	Suction	Pressurized	Pressurized
	<b>10</b>  <b>ATG</b> p 17	Method	Method	Method	Method (circle one)  European  American/ Standard	Method (circle one)  ELLD  MLLD	Method (circle one)  LTT SIR ELLD IM
Testing Frequency	Testing Frequency  Monthly (Weekly if near well)	Testing Frequency	Testing Frequency	Testing Frequency	Testing Frequency	Testing Frequency	Testing Frequency
Documentation	Documentation  12 months of results	Documentation	Documentation	Documentation	Documentation	Documentation	Documentation
Next date	Next date / -- / --	Next date	Next date	Next date	Next date	Next date	Next date

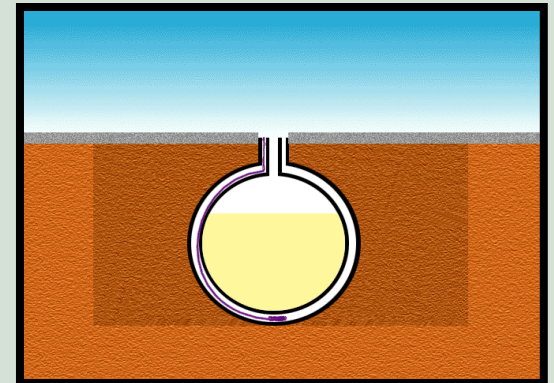
# Most Common Leak Detection Methods



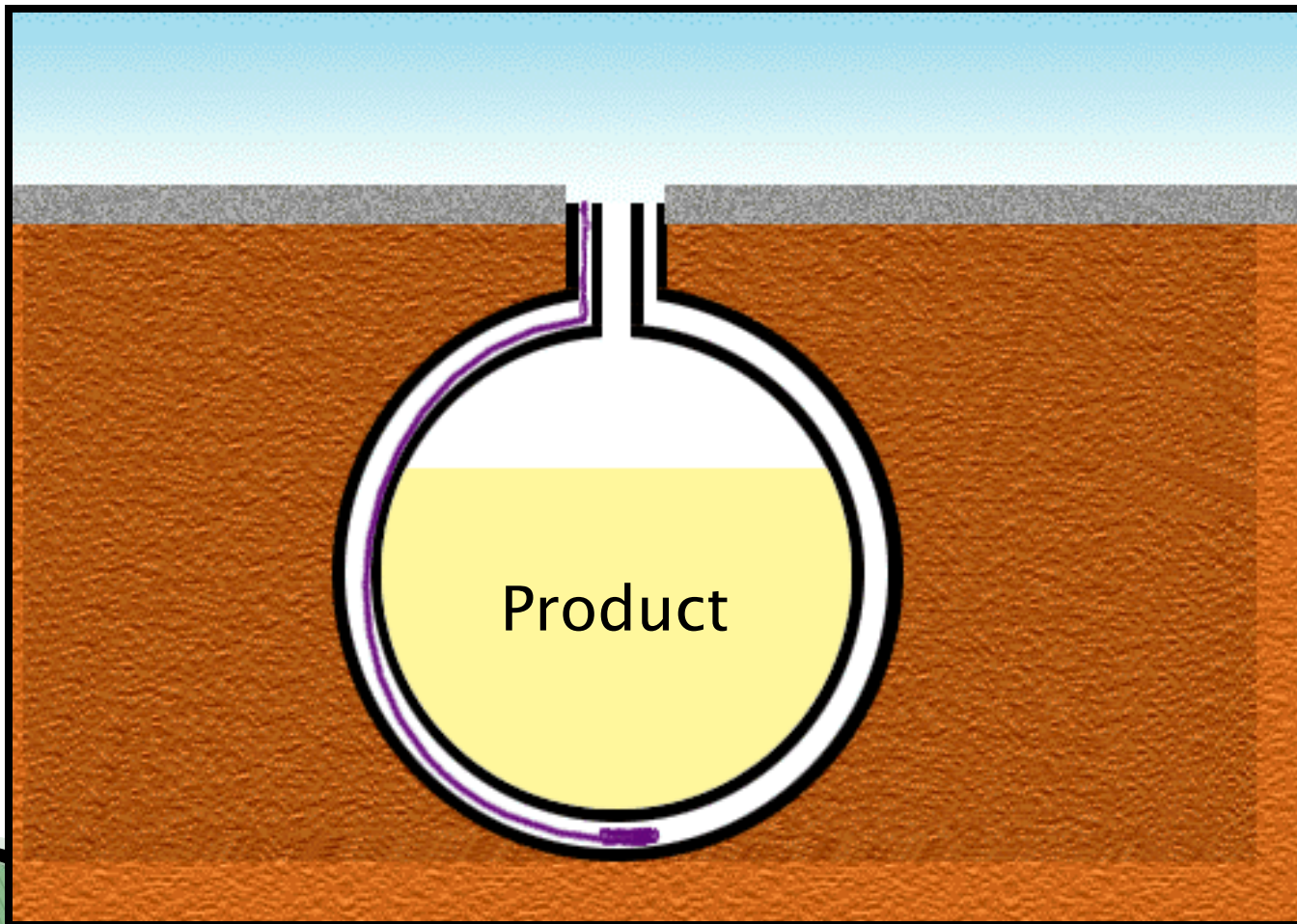
Statistical  
Inventory  
Reconciliation  
(SIR)

Automatic  
Tank Gauging  
Systems  
(ATG)

<sup>C</sup>  
Secondary  
Containment  
w/Interstitial  
Monitoring  
(IM)



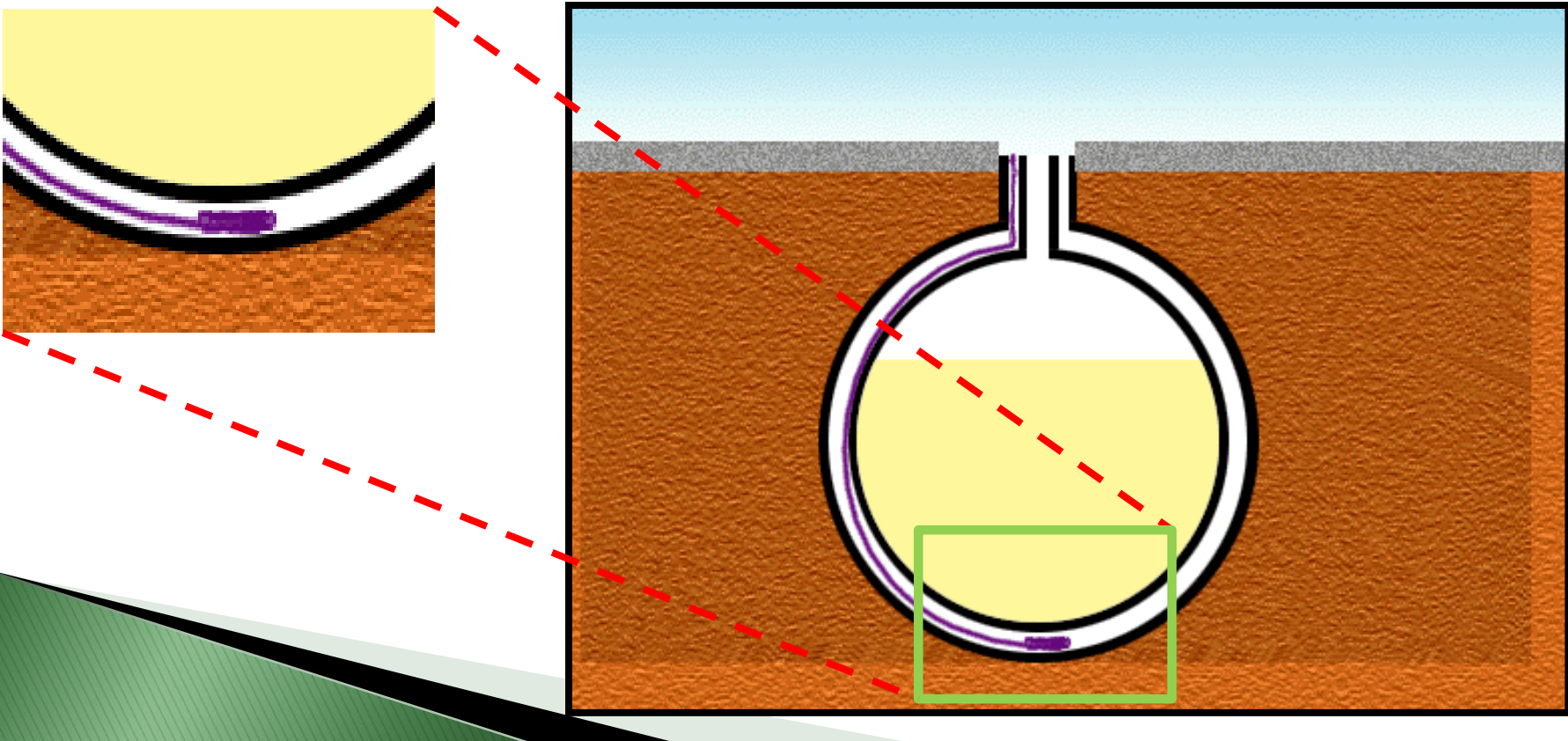
### (3) Secondary Containment with Interstitial Monitoring (IM)





# Interstitial Monitoring:

- ▶ Double Walled Tank
- ▶ Monitor space between walls (interstice)



# Interstitial Monitoring



## Electronic Sensors:

- Detect leaked *substance*:
  - Liquid (using a *Liquid-Detecting Sensor*)

OR

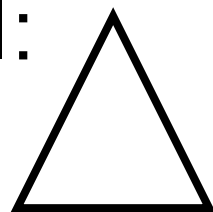
- Detect change in *condition*:
  - Vacuum loss
  - Change in brine level

# Interstitial Monitoring Console:



- Present and powered on
- No warnings  
No alarms

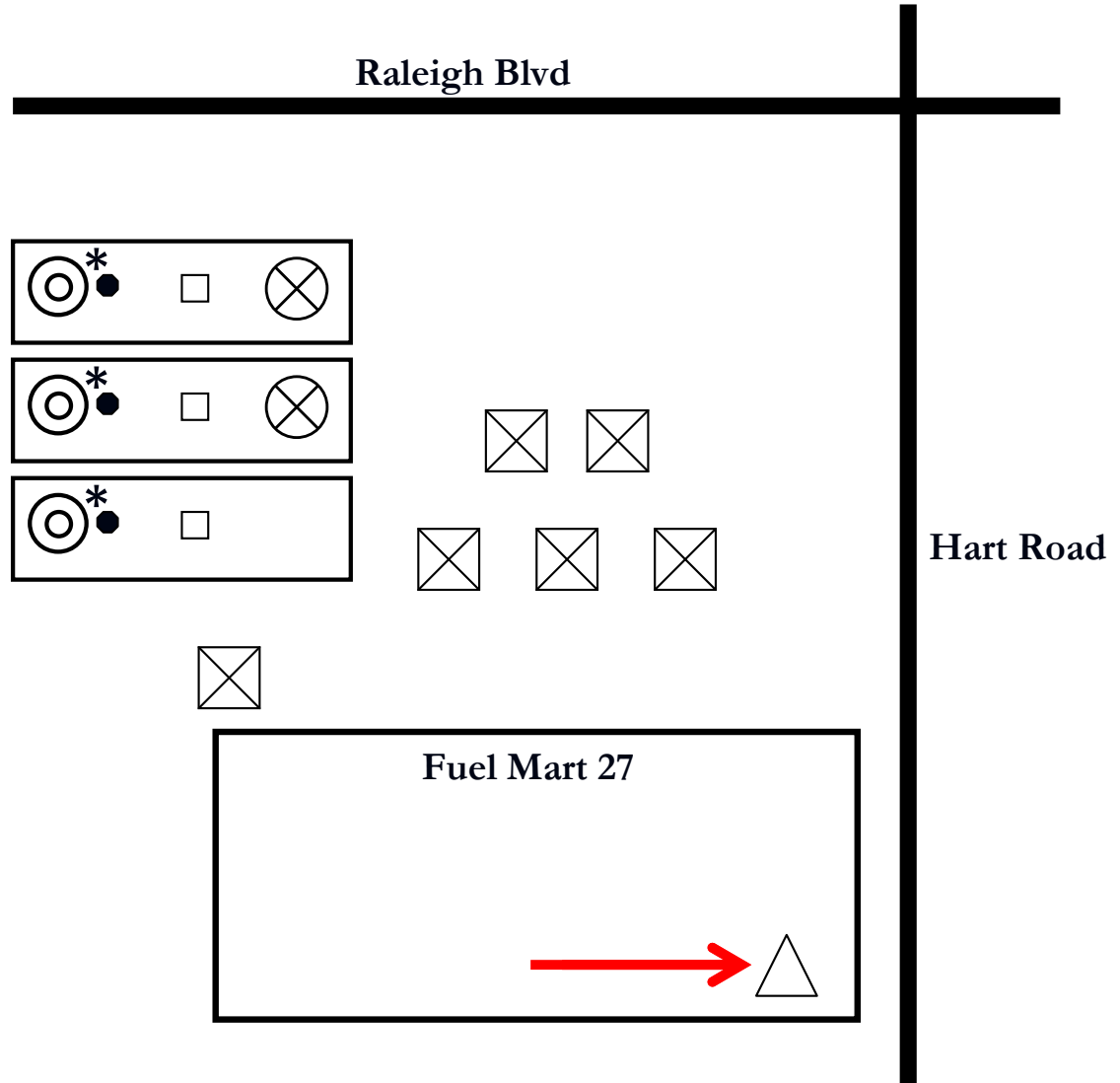
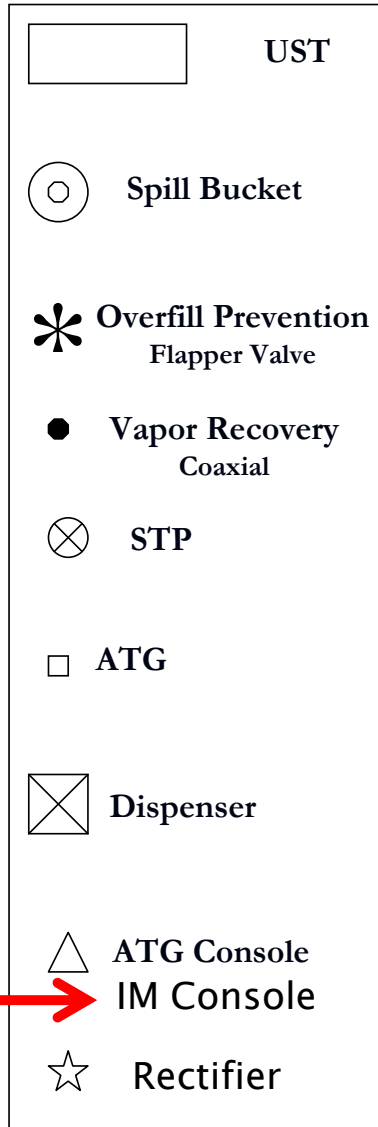
Symbol:





# UST Site Diagram for:

Fuel Mart 27



# Interstitial Monitoring Records 1 of 2:

Keep:

- 1 valid sensor status test result,
- per tank,
- PER MONTH,
- for 12 months

JUN 17, 2008 10:34 AM

SMART SENSOR STATUS ←

- - - - -

JUN 17, 2008 10:34 AM

s 1:87 T-1 INT SEN  
SENSOR NORMAL ←

\* \* \* \* \* END \* \* \* \* \*

# Interstitial Monitoring Records 2 of 2:

depends on CP Installation Date

- ▶ Find #1
- ▶ CP Installation Date is 2 rows down

## CORROSION PROTECTION

Tank Corrosion Protection	Tank #1(1A REGULAR)	Tank #2(2B PREMIUM)	Tank #3(3C DIESEL)
DWM notified of current CP method	Yes	Yes	Yes
Integrity assessment performed after 3/1/06	No	No	No
CP Method 1	RP	FRP	FRP
if other, Description			
CP Installation Date	10/10/2013	10/10/2013	10/10/2013
CP Method 2			
if other, Description			
CP Installation Date			
Flex Connector , Piping Extensions,	Elbow, Ball Valve	Elbow, Ball Valve	Elbow, Ball Valve

# Interstitial Monitoring Records 2 of 2:

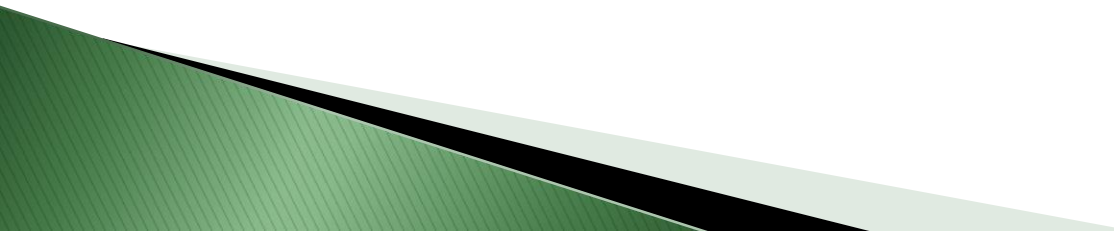
Recommended for  
tanks installed  
BEFORE 11/1/2007:

- one alarm history report printed,
- per tank sensor,
- PER YEAR

REQUIRED for  
tanks installed  
AFTER 11/1/2007:

- one alarm history test result printed,
- per tank sensor,
- PER MONTH,
- for 12 months

# Interstitial Monitoring without sensor

- ▶ Double-walled tank installed BEFORE 11/1/2007 may have “port” or opening for checking interstice
  - ▶ Maintain monthly log for each tank; keep previous 12 months
- 



# Tanks installed after 11/1/07:

## ► REQUIREMENT:

- Annual Tank Sensor check
- Complete UST-22B form

# Tanks installed after 11/1/07:

- ▶ REQUIREMENT: ( if using 'Liquid Detecting Sensor' )
  - Interstice Tightness Test
  - Frequency: – At time of installation,
    - 6 to 12 months after install
    - Every 3 years
  - Complete UST-6E/23D form

This comes after the # 11 in your inspection checklist IF you have it



### INTERSTITIAL MONITORING AFTER 11/1/07

IM After 11/07-Consoles	IM Console #1
Manufacturer/Model of Interstitial Monitoring Console	
If other, describe	

**Liquid-detecting (dry) sensor**




IM After 11/07-Tanks	Tanks #2(A1B)
Manufacturer/Model of Sensor	
If other, describe	
Monitoring Type	
Sensor third party certified	
Sensor Operability Check Date (annually)	
Sensor Operability Check Results	
Tightness Test Date	
Interstice Tightness Test Result	
Tightness test 3rd party certified	
Method available to determine sensor at lowest point of interstice	
Sensor at lowest point of interstice	
Sensor activates an alarm for any liquid	
Liquid removed from interstice within 48 hours	

# Tank Leak Detection

Tank Corrosion Protection	Tank Leak Detection	Piping Corrosion Protection			Piping Leak Detection – (circle one)		
	10				Suction / Pressurized / Both		
Method	Method	Tank end	Main Run	Dispenser end	Suction	Pressurized	Pressurized
	IM p. 18	Method	Method	Method	Method (circle one)  European  American/ Standard	Method (circle one)  ELLD  MLLD	Method (circle one)  LTT SIR ELLD IM
Testing Frequency	Testing Frequency	Testing Frequency	Testing Frequency	Testing Frequency	Testing Frequency	Testing Frequency	Testing Frequency
	Monthly Yearly  (2007)						
Documentation	Documentation	Documentation	Documentation	Documentation	Documentation	Documentation	Documentation
	Sensor status  Alarm history [log]						
Next date	Next date	Next date	Next date	Next date	Next date	Next date	Next date
	--/--/---						

# Other Leak Detection Methods on UST-10B:

- Enhanced Leak Detection
  - Inventory Control *and* Tightness Testing
  - Manual Tank Gauging *and* Tightness Test
  - Groundwater Monitoring
  - Vapor Monitoring
  - Mechanical Vacuum Gauging
- 



# EXAM

- ▶ Please answer questions 18 – 25
- ▶ Take a Break

# Leak Detection: Piping

North Carolina Department of Environment and Natural Resources  
Division of Waste Management  
Underground Storage Tank Section

# Why conduct Leak Detection?

To discover a release before a major contamination incident occurs

Required for all regulated systems:

## EXCEPTIONS:

- Temporarily closed UST systems
- Emergency generator UST systems installed before 11/1/07

# Leak Detection Requirements

- ▶ **Third Party Certification:**
  - Installed, calibrated, operated and maintained per **manufacturer's instructions.**
  - Documentation that your leak detection method works for your UST system
  - Keep documents for **inspection**

## **ALL METHODS HAVE LIMITATIONS:**

- e.g.,: Tank size, Minimum fuel levels, Throughput, “Down time”

# Configurations of Piping Systems

- ▶ Suction:
  - European Suction [safe]
  - American Suction [standard]
- ▶ Pressurized



# #8, #9, #10 on checklist

## Leak Detection

### General

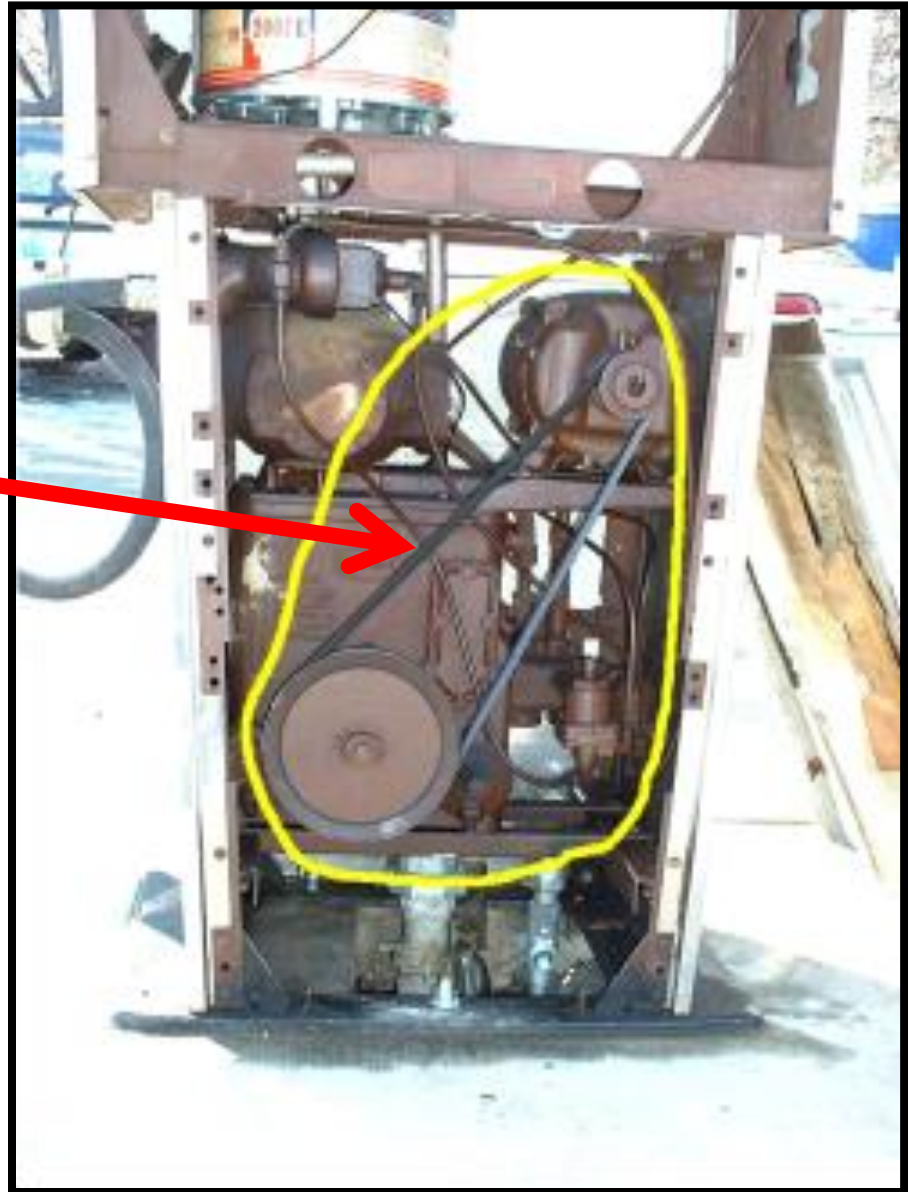
**8 – Piping Type**

**9 – Type LLD Present**

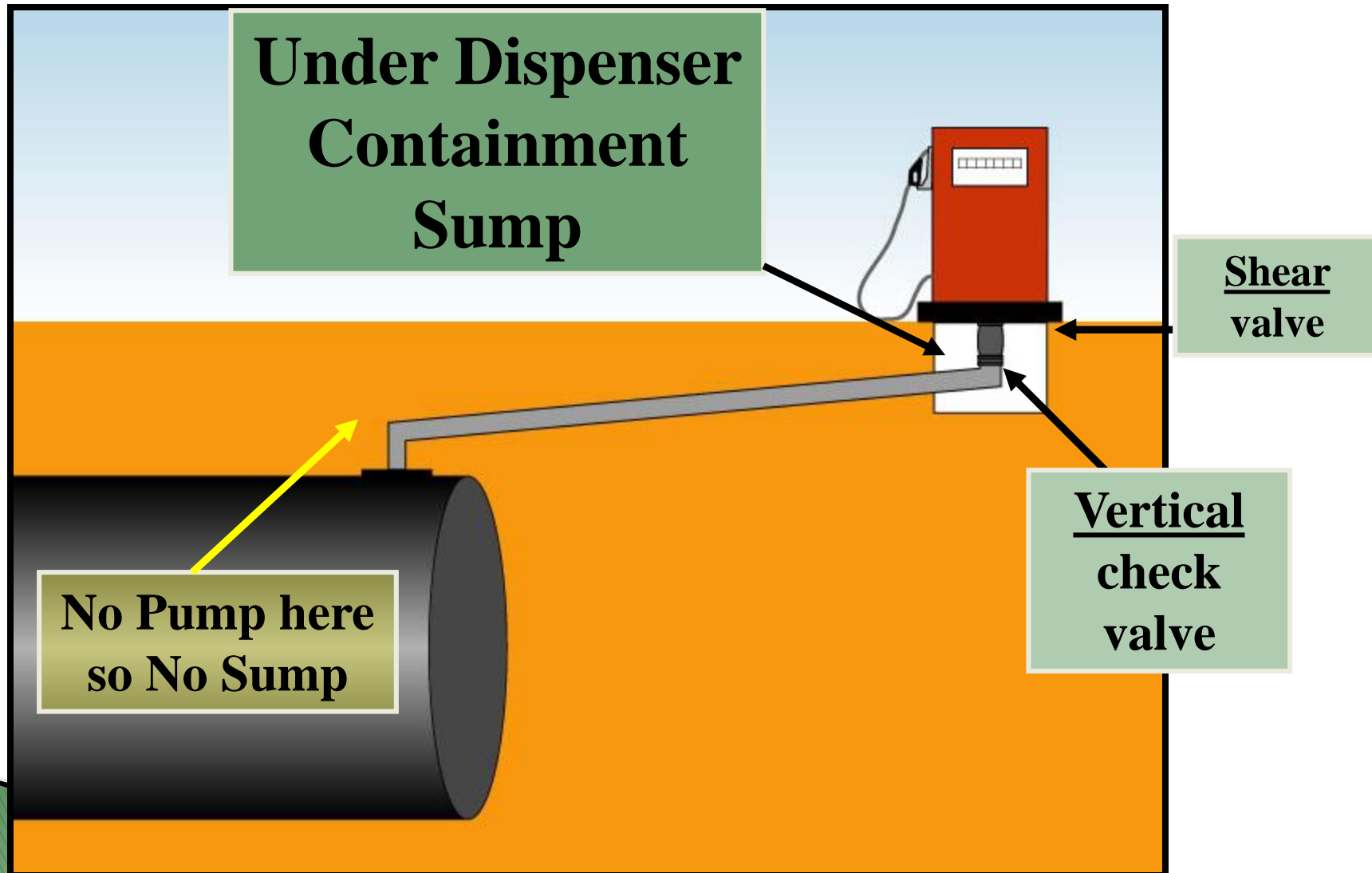
**11 – Piping Primary leak detection method**

# SUCTION SYSTEMS

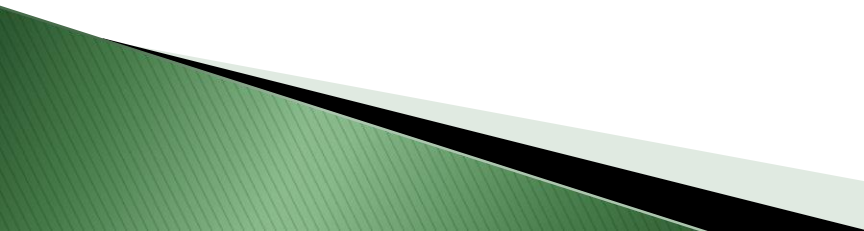
Pump is under  
dispenser



# European (safe) Suction



# European Suction:

- ▶ Piping slopes back to tank,  
AND
  - ▶ Piping operates at *less than*  
atmospheric pressure,  
AND
  - ▶ Only one check valve, located at  
dispenser
- 

# European Suction Requirements:

Installed BEFORE 11 / 1 / 2007:

- Leak detection is **NOT** required

Installed or replaced AFTER 11 / 1 / 2007:

- **Interstitial Monitoring (IM)** is required  
(info at end of unit)



# European Suction Requirements

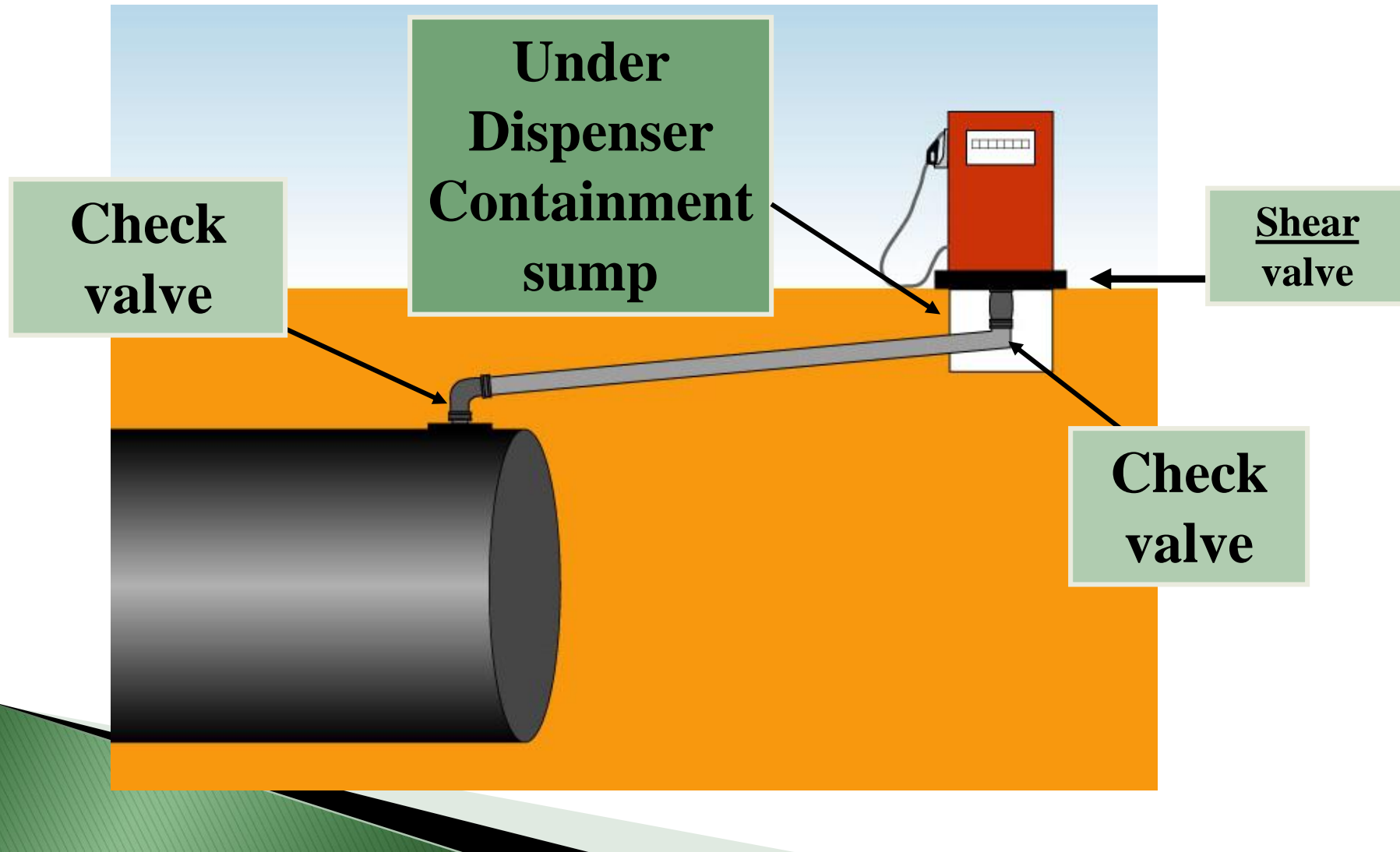


- ▶ **UST 19 form – completed by installer or contractor *to verify* an exempt suction system**
- ▶ **Keep completed UST–19 form**
- ▶ **Keep all records of maintenance and repairs**

# Leak Detection – Piping

Tank Corrosion Protection	Tank Leak Detection	Piping Corrosion Protection			Piping Leak Detection – (circle one)		
		Tank end	Main Run	Dispenser end	Suction	Pressurized	Pressurized
Method	Method	Method	Method	Method	Method (circle one) European American/ Standard p. 19	Method (circle one) ELLD MLLD	Method (circle one) LTT SIR ELLD IM
Testing Frequency	Testing Frequency	Testing Frequency	Testing Frequency	Testing Frequency	Testing Frequency N/A	Testing Frequency	Testing Frequency
Documentation	Documentation	Documentation	Documentation	Documentation	Documentation UST 19	Documentation	Documentation
Next date	Next date	Next date	Next date	Next date	Next date N/A	Next date	Next date

# Standard (American) Suction



# Standard Suction Piping Requirements:

- ▶ Installed BEFORE 11 / 1 / 2007:
  - Line Tightness Test every 3 years
  - SIR
- ▶ Installed or replaced AFTER 11 / 1 / 2007:
  - Interstitial Monitoring (IM) is required  
(info at end of unit)

# Leak Detection – Piping

Tank Corrosion Protection	Tank Leak Detection	Piping Corrosion Protection			Piping Leak Detection – (circle one)		
		Tank end	Main Run	Dispenser end	Suction	Pressurized	Pressurized
Method	Method	Method	Method	Method	Method (circle one)  European <b>American/Standard</b> <b>P 20</b>	Method (circle one)  ELLD 9 MLLD	Method (circle one)  LTT SIR ELLD IM
Testing Frequency	Testing Frequency	Testing Frequency	Testing Frequency	Testing Frequency	Testing Frequency  <b>LTT 3 years or SIR</b>	Testing Frequency	Testing Frequency
Documentation	Documentation	Documentation	Documentation	Documentation	Documentation  <b>LTT results or 12 mos. SIR</b>	Documentation	Documentation
Next date	Next date	Next date	Next date	Next date	Next date --/--/--	Next date	Next date

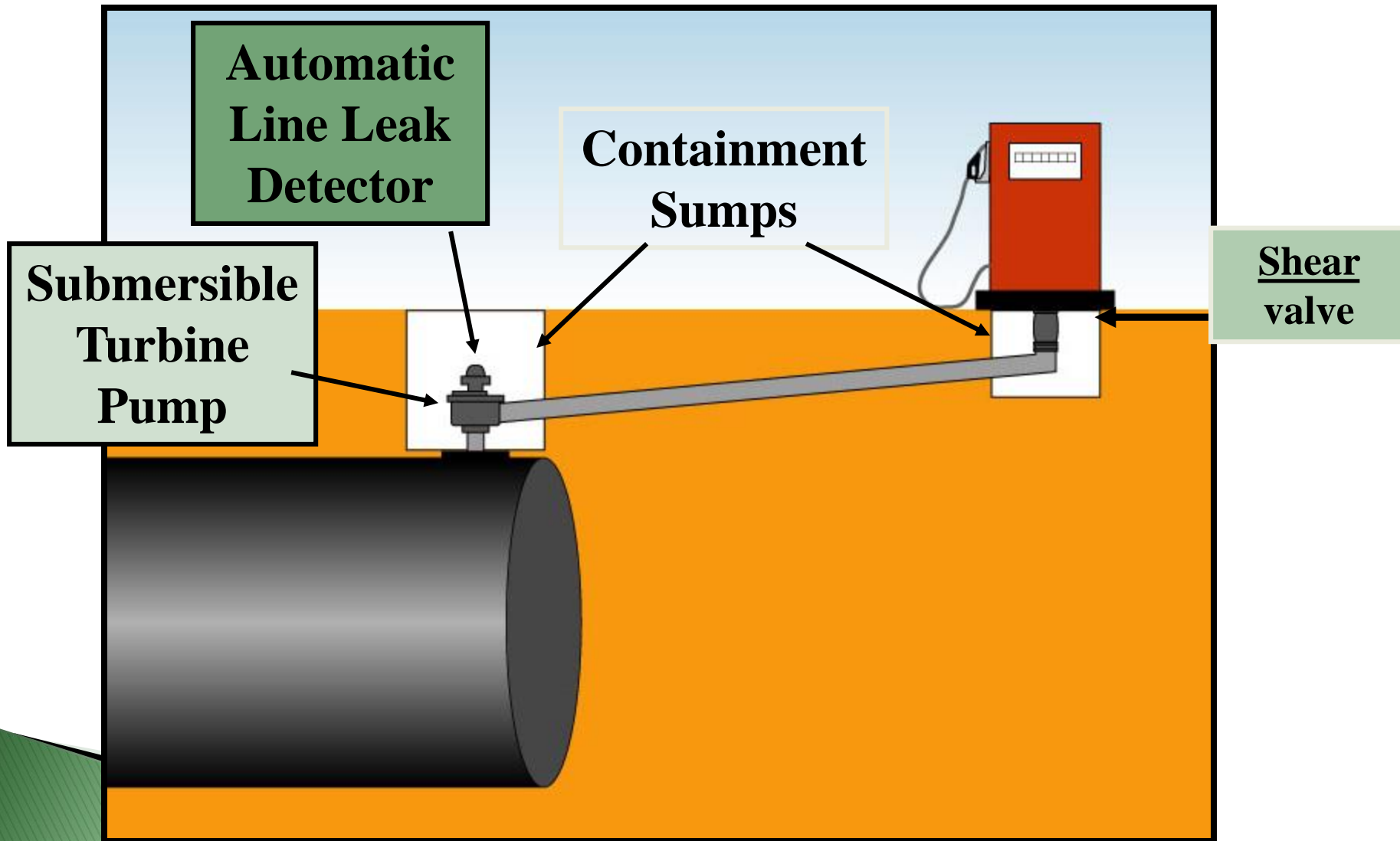
# Leak Detection – Piping

## Leak Detection

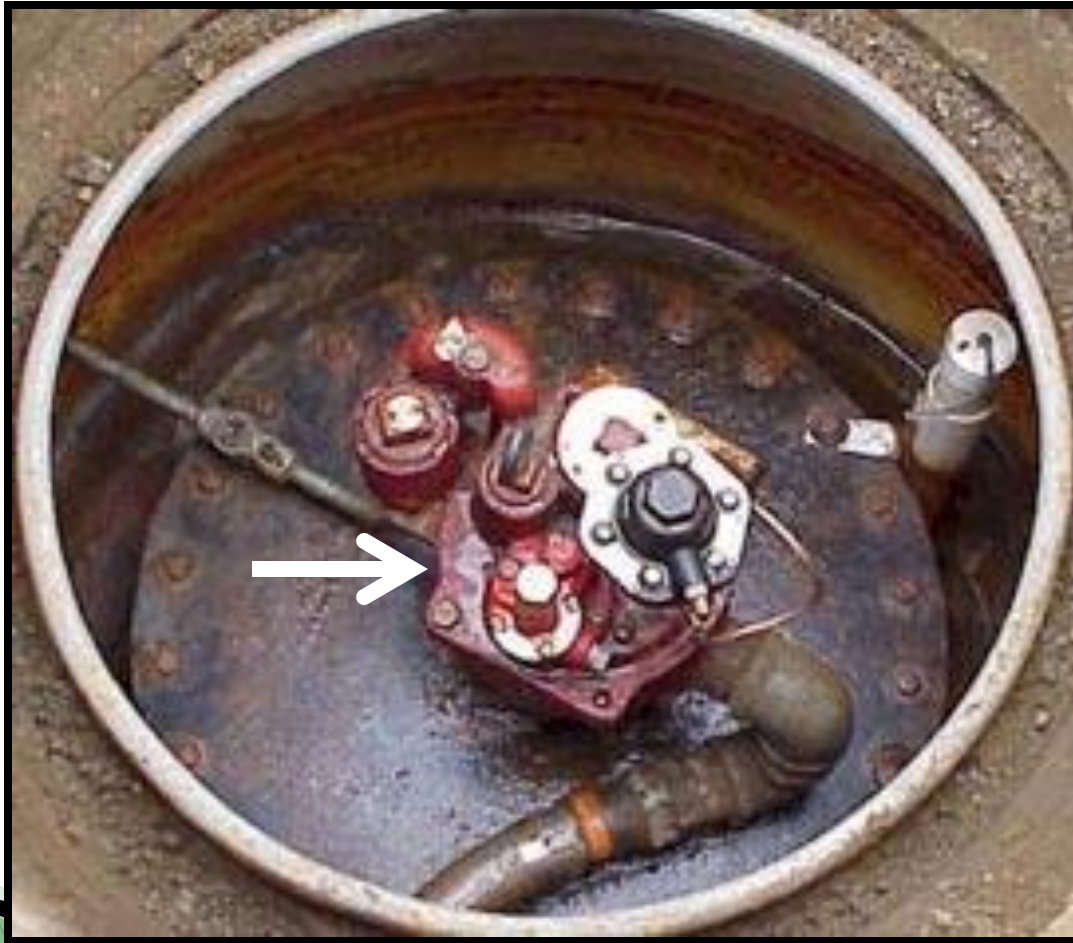
### 9 – Type LLD Present



# Pressurized Piping Description:



# STP (Submersible Turbine Pump) of a Pressurized System



# Pressurized Piping – Leak Detection –

Automatic Line Leak Detector	AND	Piping Primary Leak Detection Method <i><u>One Required</u></i>			
		LTT Line Tightness Test	SIR Statistical Inventory Reconciliation	ELLD Electronic Line Leak Detector	IM Interstitial Monitoring

# Automatic Line Leak Detectors



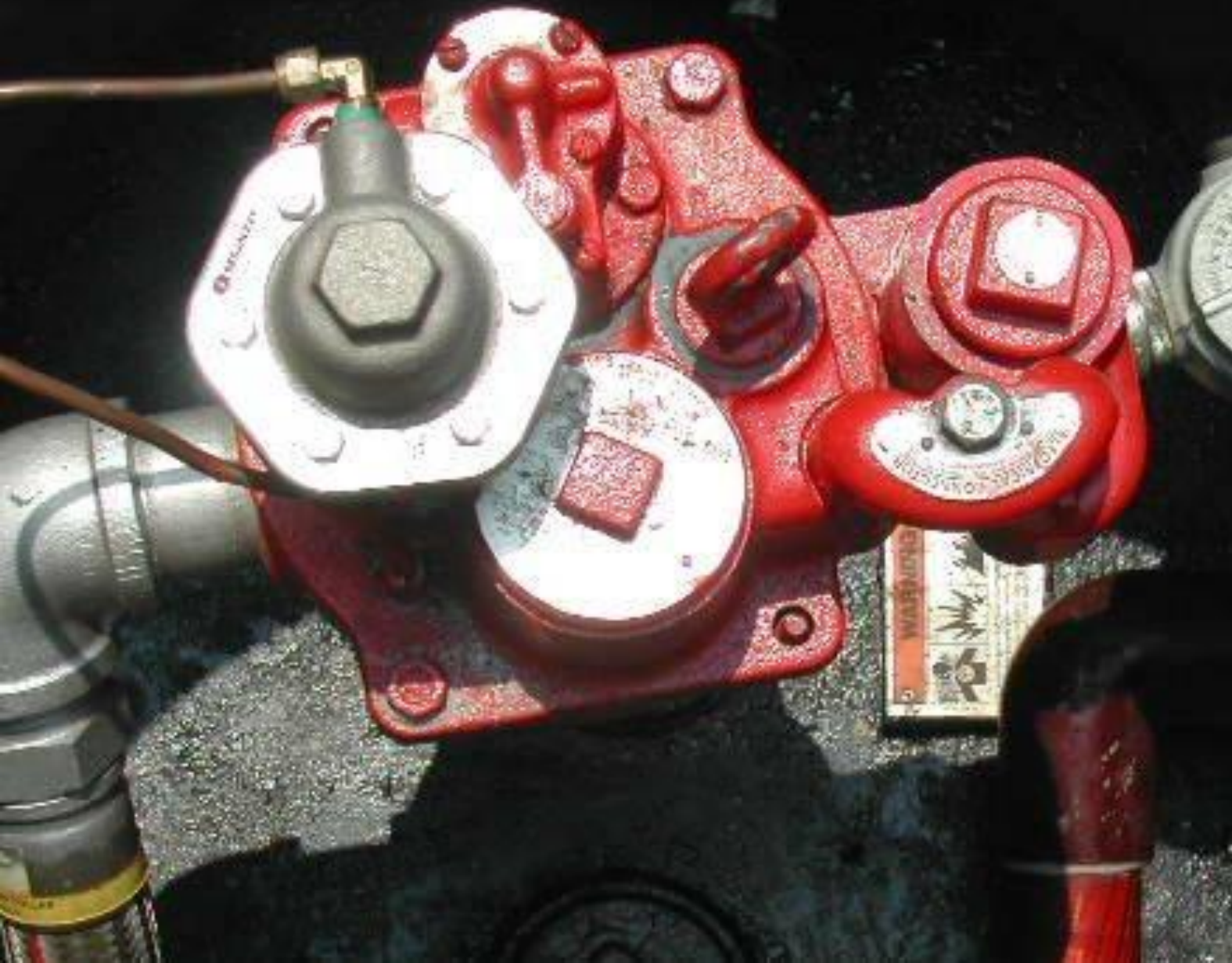
- Detects catastrophic leaks (3.0 gph)
- May slow flow of fuel if triggered

**MLLD**



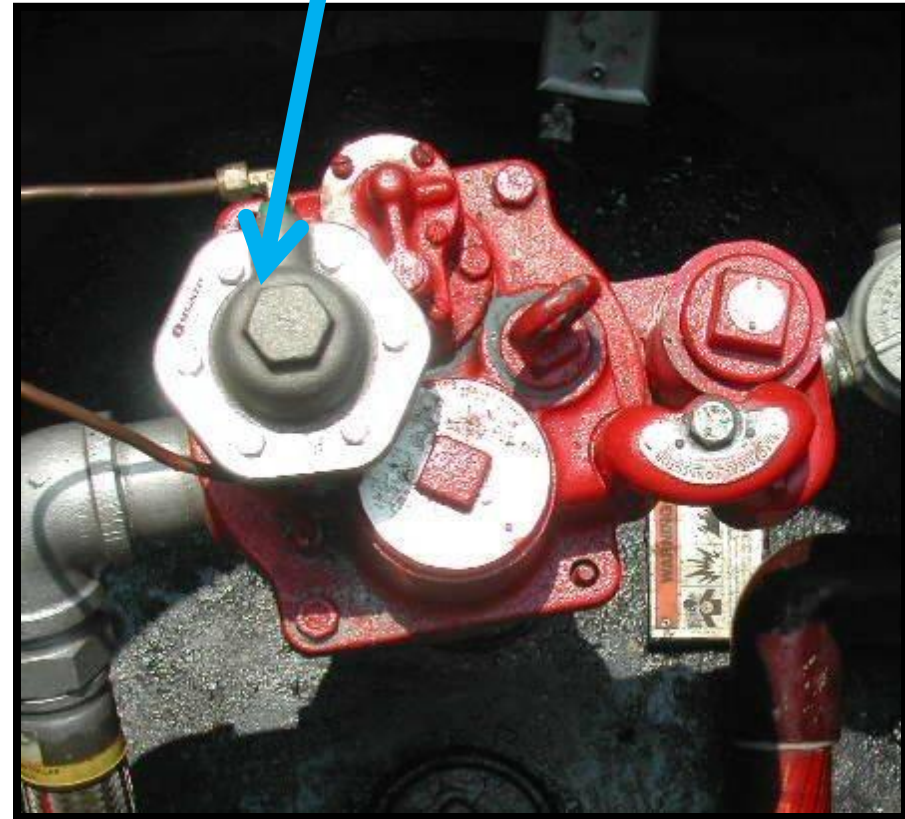


# Mechanical Line Leak Detector



# Mechanical Line Leak Detector

- Test Required  
Every 12 months
- *Contractor* should check for proper operation
- Keep report for inspector





# Electronic Line Leak Detector



# Electronic Line Leak Detector:

- Test Required Every 12 months
- *Contractor/Console* check operation
- Keep report or print-out for inspector
- Should be programmed to shut down STP if triggered



# Leak Detection – Piping

Tank Corrosion Protection	Tank Leak Detection	Piping Corrosion Protection			Piping Leak Detection – (circle one)		
		Tank end	Main Run	Dispenser end	Suction	Pressurized	Both
Method	Method	Method	Method	Method	Method (circle one)	Method (circle one)	Method (circle one)
					<div> <div>Circle one</div> <div> <div>ELLD</div> <div>MLLD</div> </div> </div>	<div> <div>p 20</div> <div>p 21</div> </div>	
Testing Frequency	Testing Frequency	Testing Frequency	Testing Frequency	Testing Frequency	Testing Frequency	Testing Frequency	Testing Frequency
						Tested yearly	
Documentation	Documentation	Documentation	Documentation	Documentation	Documentation	Documentation	Documentation
						Test results	
Next date	Next date	Next date	Next date	Next date	Next date	Next date --/--/--	Next date

# Pressurized Piping – Leak Detection –

Automatic Line Leak Detector	<b>AND</b>	<b>Piping</b> <b>Primary Leak Detection Method</b> <i><u>One</u> Required</i>			
MLLD <i>or</i> ELLD		<b>LTT</b> (Line Tightness Test)	<b>SIR</b> (Statistical Inventory Reconciliation)	<b>ELLD</b> (Electronic Line Leak Detector)	<b>IM</b> (Interstitial Monitoring)

# Leak Detection – Piping

## 11 – Piping Primary Leak Detection Method

1. LTT (Line Tightness Test)
2. SIR
3. ELLD
4. IM (Interstitial Monitoring)  
– before or after 2007?

# A. Line Tightness Test (LTT) for Pressurized Piping Leak Detection



- ▶ Checks for **0.1 gph leak**, Every year
- ▶ Keep maintenance record forever.
- ▶ Conducted by **contractor**,  
OR  
by **ELLD** programmed to perform 0.1 gph tests



# Leak Detection – Piping

[illegible]

# B. SIR – for Pressurized Piping Leak Detection



## SIR MONTHLY EVALUATION REPORT

001	SIR Monthly Tank Evaluation Report										Date of Report: 06-15-2009									
FACILITY NAME				Country Corners Grocery										ID# 0-029446						
TANK				604 Jones Dairy Road																
LOCATION				Wake Forest, NC 27587										Tel:						
TANK OWNER				Country Corners Grocery																
LOCATION				604 Jones Dairy Road										Tel: 919-554-0461						
				Wake Forest, NC 27587																
TANK OPERATOR				Tel:																
SIR Provider				TotalSIR P.O. Box 2040 Cornelius, NC 28031																
SIR Version				TotalSIR 1.0 <ID:SIR71005>										Site Dir: 50142						
Period Covered				05/09				23 usable days per month required.												
TANK				Current Month						04/09		03/09								
Tank ID.	Product	Max. SIR size (gal)	size (gal)	Leak Thres hold (gph)	MDL rate (gph)	Calc. Leak rate (gph)	Water (in)	Pass, Fail, or Inconclusive												
								P	F	I	P	F	I	P	F	I	P	F	I	
Unlead	Unlead	45 K	10028	0.200	0.001	0.000		X				X				X				
Premium	Premium	45 K	10028	0.200	0.000	0.000		X				X				X				

- ▶ Submit dispenser meter readings to SIR vendor to have SIR cover piping
- ▶ SIR cannot be used for leak detection for piping to a satellite dispenser

# Leak Detection – Piping

Tank Corrosion Protection	Tank Leak Detection	Piping Corrosion Protection			Piping Leak Detection – (circle one)		
		Tank end	Main Run	Dispenser end	Suction / <b>Pressurized</b> / Both	Pressurized	Pressurized
Method	Method	Method	Method	Method	Method (circle one)  European  American/ Standard	Method (circle one)  ELLD  MLLD	Method (circle one)  LTT <b>SIR</b> ELLD IM
Testing Frequency	Testing Frequency	Testing Frequency	Testing Frequency	Testing Frequency	Testing Frequency	Testing Frequency	Testing Frequency
Documentation	Documentation	Documentation	Documentation	Documentation	Documentation	Documentation	Documentation
Next date	Next date	Next date	Next date	Next date	Next date	Next date	Next date

1 1

p 21-22

p 21-22

p 21-22

--/--/--

# SIR

*method*

SIR

page 21–22

*testing frequency*

Product daily,  
Water monthly,  
Submit to vendor monthly

*documentation*

Calibration charts,  
12 months daily fuel,  
12 months monthly water,  
12 months SIR reports from vendor

*next test date*

--/--/--

# C. ELLD – for Pressurized Piping Leak Detection

- Keep one 0.2 gph printout, for *each piping run*, Every month
- Keep one year's worth of results

JUL 13. 2006 3:36 PM  
PRESSURE LINE LEAK TEST  
RESULTS

Q 1:REG

3.0 GAL/HR RESULTS:

LAST TEST:  
JUL 13.2006 3:33PM PASS

NUMBER OF TESTS PASSED  
PREV 24 HOURS : 184  
SINCE MIDNIGHT : 96

0.20 GAL/HR RESULTS:

JUL 12.2006	11:23PM	PASS
JUL 10.2006	5:07AM	PASS
JUL 6.2006	11:46PM	PASS
JUL 4.2006	6:46AM	PASS
JUN 30.2006	1:36AM	PASS
JUN 26.2006	11:22PM	PASS
JUN 22.2006	2:01AM	PASS
JUN 18.2006	10:56PM	PASS
JUN 16.2006	4:56AM	PASS
JUN 12.2006	10:44PM	PASS

# Leak Detection – Piping

Tank Corrosion Protection	Tank Leak Detection	Piping Corrosion Protection			Piping Leak Detection – (circle one)		
					Suction	Pressurized	Both
Method	Method	Method	Method	Method	Method (circle one)	Method (circle one)	Method (circle one)
					European	ELLD	LTT
					American/Standard	MLLD	SIR
							ELLD
							IM
Testing Frequency	Testing Frequency	Testing Frequency	Testing Frequency	Testing Frequency	Testing Frequency	Testing Frequency	Testing Frequency
							monthly
Documentation	Documentation	Documentation	Documentation	Documentation	Documentation	Documentation	Documentation
							12 month of 0.2 gph printouts
Next date	Next date	Next date	Next date	Next date	Next date	Next date	Next date

1 1

p 22



# D. Interstitial Monitoring (IM) for Pressurized Piping Leak Detection

- Requirements depend on *when* piping was installed:

BEFORE 11/1/07


or

AFTER 11/1/07

# Interstitial Monitoring


depends on Pipe Installation Date

- ▶ Find #1
- ▶ Date Pipe Installed is in section above



If other, describe			
Tank material verified by	Design Plans/UST-6B	Design Plans/UST-6B	Design Plans/UST-6B
<b>Date Pipe Installed</b>	11/21/2013	11/21/2013	11/21/2013
Was UST Piping Installed on or after 11/1/2007?	Yes	Yes	Yes
Piping Construction Material (DW required after 11/1/07)	Double Wall Flex	Double Wall Flex	Double Wall Flex
If other, description			
Pipe Manufacturer/Model	OPW: Flexworks	OPW: Flexworks	OPW: Flexworks
If other, describe			
Pipe material verified by	Design Plans/UST-6B	Design Plans/UST-6B	Design Plans/UST-6B
If E-blend > 10% or Biodiesel Blend > 20%; Was UST-20 completed and approved?	N/A	N/A	N/A

## CORROSION PROTECTION



Tank Corrosion Protection	Tank #1(1A REGULAR)	Tank #2(2B PREMIUM)	Tank #3(3C DIESEL)
DWM notified of current CP method	Yes	Yes	Yes
Integrity assessment performed after 3/1/06	No	No	No
CP Method 1	FRP	FRP	FRP
If other, Description			

1

# Interstitial Monitoring (IM)

## BEFORE 11/1/07:

- Piping interstice is open to sump
- Sump sensor 2" from bottom typical, but not required
- Use sensor OR visually inspect sumps for product / water



# Interstitial Monitoring (IM)

## BEFORE 11 / 1 / 07:

For **ALL** containment sumps

- One valid ***SENSOR STATUS*** test result for each sensor
  - Per month
  - for 12 months

**OR**

- ***WRITTEN LOG*** (sump check) for each sump,
    - Per month
    - for 12 months
- 

# Leak Detection – Piping

Tank Corrosion Protection	Tank Leak Detection	Piping Corrosion Protection			Piping Leak Detection – (circle one)		
		Tank end	Main Run	Dispenser end	Suction	Pressurized	Both
Method	Method	Method	Method	Method	Method (circle one)	Method (circle one)	Method (circle one)
					European	ELLD	LTT
					American/Standard	MLLD	SIR
							ELLD
							IM
Testing Frequency	Testing Frequency	Testing Frequency	Testing Frequency	Testing Frequency	Testing Frequency	Testing Frequency	Testing Frequency
Documentation	Documentation	Documentation	Documentation	Documentation	Documentation	Documentation	Documentation
Next date	Next date	Next date	Next date	Next date	Next date	Next date	Next date



# Interstitial Monitoring (IM) after 11 / 1 / 07

- Piping interstice is open to sump
- Sump sensor **REQUIRED** (*less than 2"* from bottom)



- Sump sensor **continuously** monitors for leaks
- ✓ The requirements in this section also apply to suction piping installed after 11-1-2007

# Interstitial Monitoring (IM) after 11/1/07

Needed for **ALL containment** sumps

- One valid **SENSOR STATUS** test result,
  - Per month,
  - for 12 months

**AND**

- One **ALARM HISTORY** test result,
    - Per month,
    - for 12 months
- 



# Interstitial Monitoring AFTER 11/1/07:

## REQUIRED Checks:

- Sump SENSORS – Every year – UST 22B
  - Sump INTERIOR – Every year – UST 22C
- 
- Sump Integrity – Every 3 years – UST 23B
  - Piping Integrity – Every 3 years – UST 23C

*(\*Integrity = Tightness Test)*



# Leak Detection – Piping

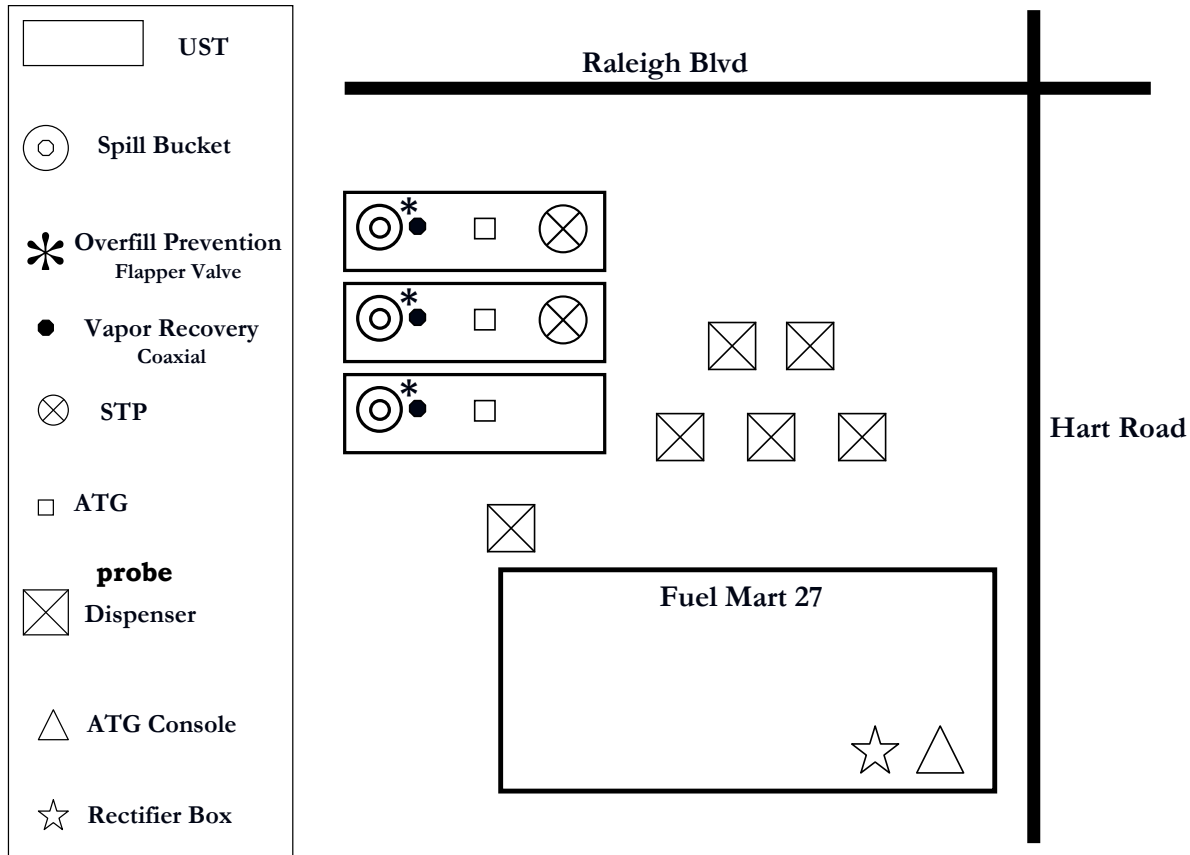
Tank Corrosion Protection	Tank Leak Detection	Piping Corrosion Protection			Piping Leak Detection – (circle one)		
		Tank end	Main Run	Dispenser end	Suction / <b>Pressurized</b> / Both	Pressurized	Pressurized
Method	Method	Method	Method	Method	Method (circle one)  European  American/ Standard	Method (circle one)  ELLD  MLLD  <b>IM</b>	Method (circle one)  LTT  SIR  ELLD  IM  11
Testing Frequency	Testing Frequency	Testing Frequency	Testing Frequency	Testing Frequency	Testing Frequency	Testing Frequency	Testing Frequency          p22
Documentation	Documentation	Documentation	Documentation	Documentation	Documentation	Documentation	Documentation          p22
Next date	Next date	Next date	Next date	Next date	Next date	Next date	--/--/-- Next date

# Completed Compliance Plan

Tank Corrosion Protection <b>#1</b>	Tank Leak Detection <b>#10</b>	Piping Corrosion Protection			Piping Leak Detection – (circle one)		
		<b>#2</b>	<b>#3</b>	<b>#4</b>	Suction / Pressurized / Both <b>#8</b>		
Method	Method	Tank end Method	Main Run Method	Dispenser end Method	Suction Method (circle one) European <b>#8</b> American/ Standard	Pressurized Method (circle one) ELLD <b>#9</b> MLLD	Pressurized Method (circle one) LTT <b>#11</b> SIR ELLD IM
Testing Frequency	Testing Frequency	Testing Frequency	Testing Frequency	Testing Frequency	Testing Frequency	Testing Frequency	Testing Frequency
<b>Section 5</b>	<b>Section 7</b>	<b>Section 6</b>			<b>Section 8</b>		
Documentation	Documentation	Documentation	Documentation	Documentation	Documentation	Documentation	Documentation
Next date	Next date	Next date	Next date	Next date	Next date	Next date	Next date

# Completed UST Site Diagram:

UST Site Diagram for: Fuel Mart 27



NOT  
Record  
Keeping



# Next UP:

- ▶ Fuel Releases



# Releases

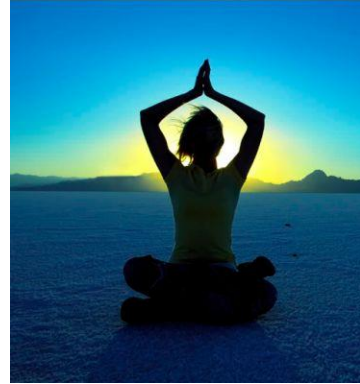
NCDENR  
Division of Waste Management  
Underground Storage Tank Section

# Types of Releases:

- ▶ Suspected
- ▶ Confirmed

# Reasons to Suspect a Release

- ▶ Leak Detection Failures
- ▶ Unusual Operating Conditions
- ▶ Environmental Conditions



# Leak Detection Failures

## ► Interstitial Monitoring:

➡ Sensor report indicates:  
**ALARM**

### ALARM HISTORY REPORT

----- SENSOR ALARM -----

L 2:PREM SUMP

STP SUMP

**FUEL ALARM**

JUL 22, 2006 10:12 PM

**FUEL ALARM**

SEP 20, 2005 8:27 PM

**FUEL ALARM**

FEB 22, 2005 5:03 PM

# Leak Detection Failures:

## ► Automatic Tank Gauge (ATG)

 Report indicates:  
**FAIL or INCREASE**

FUEL EXPRESS # 125  
21657 SHALLOWFORD RD  
LEWISVILLE NC

JUL 13, 2006 3:36 PM

CSLD TEST RESULTS

-----  
JUL 13, 2006 3:36 PM

T 1:REG  
PROBE SERIAL NUM 426185

0.2 GAL/HR TEST  
PER: JUL 13, 2006 **FAIL**

\*\*\*\*\* END \*\*\*\*\*

FUEL EXPRESS # 125  
21657 SHALLOWFORD RD  
LEWISVILLE NC

JUL 13, 2006 3:36 PM

CSLD TEST RESULTS

-----  
JUL 13, 2006 3:36 PM

T 1:REG  
PROBE SERIAL NUM 426185

0.2 GAL/HR TEST  
PER: JUL 13, 2006 **INCR**

\*\*\*\*\* END \*\*\*\*\*

# Leak Detection Failures:

## ► Statistical Inventory Reconciliation (SIR)

Tank	Tank and Line Status	Calculated Leak Rate gph	Product	Capacity Gallons	Sales Gallons	Deliveries Gallons
M1	Inconclusive	NA	MID UNLEAD	10000	4725	4697
P1	Pass	-0.12	PREMIUM	10000	3419	4791
U1	Pass	-0.04	UNLEADED	10000	59712	62843



Report indicates FAIL, INCONCLUSIVE, or anything other than pass, for ANY MONTH

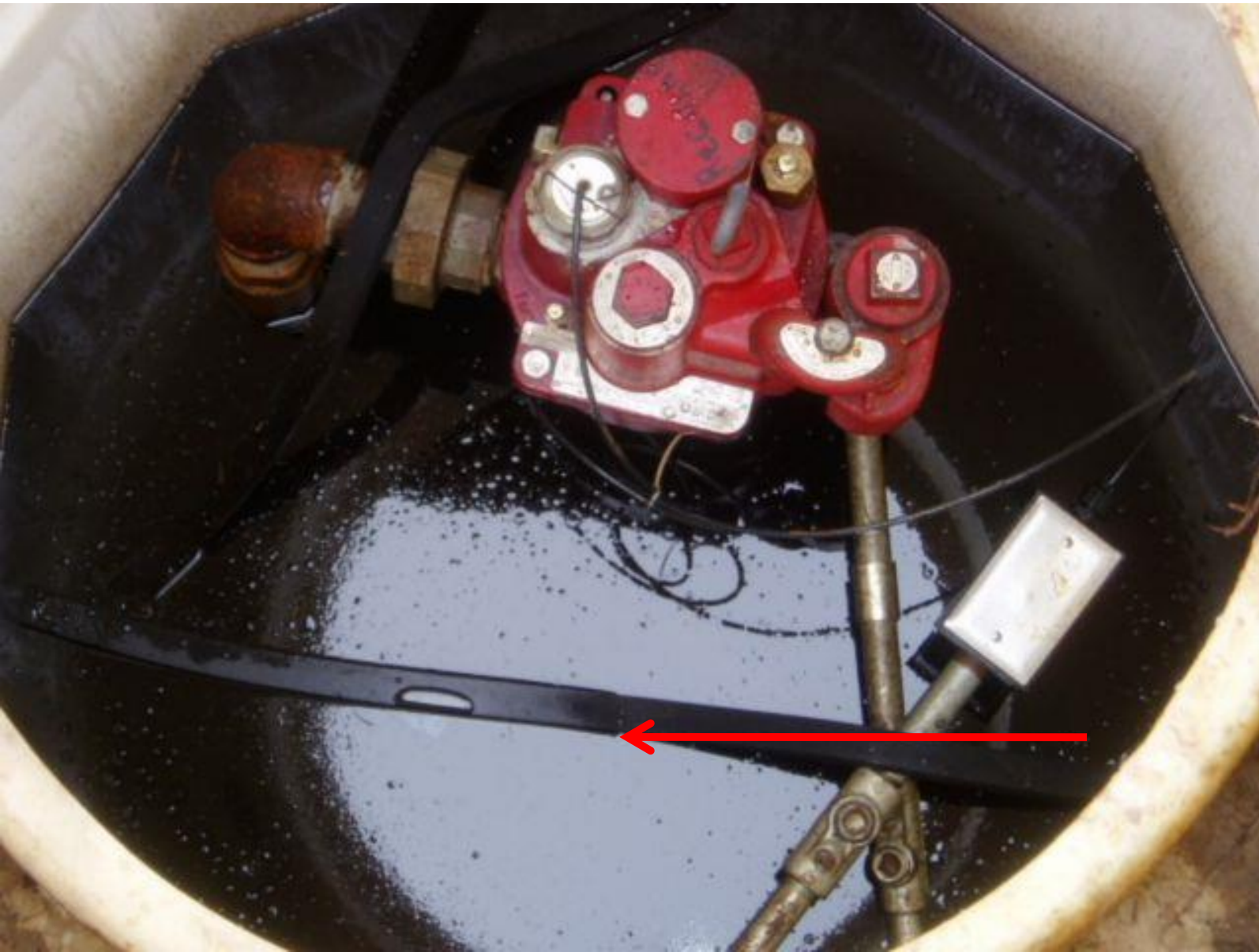


# Operating / Environmental Conditions



Fuel  
Spray  
from  
ALLD

# Operating / Environmental Conditions



Product  
In  
pump  
sump



# Operating / Environmental Conditions



Product  
in  
dispenser  
sump

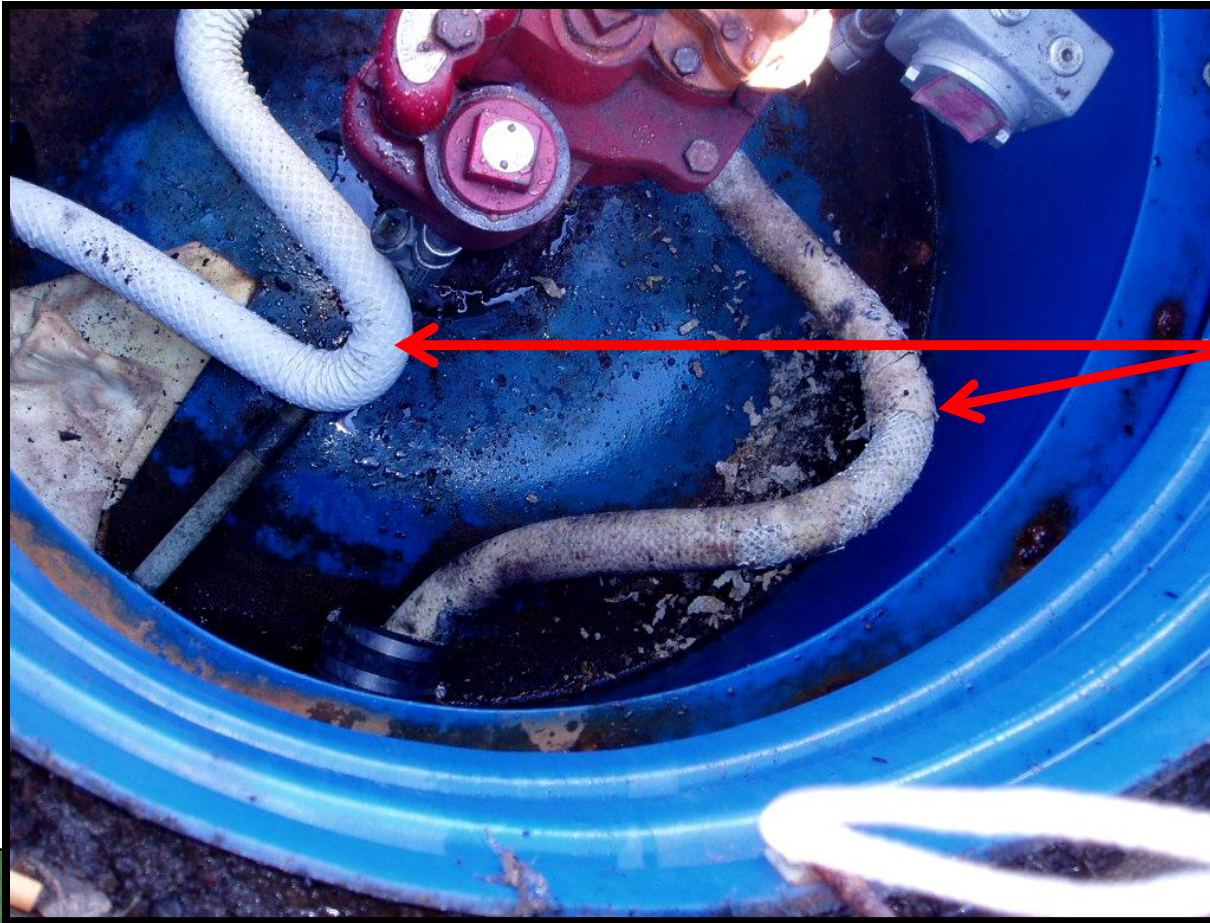
# Operating / Environmental Conditions



Flexible  
Piping  
split



# Operating / Environmental Conditions



Flexible  
Piping

- expanded

# Operating / Environmental Conditions



Cracked  
spill  
bucket



# Operating / Environmental Conditions



Stained  
soil

# Operating / Environmental Conditions



Stained  
soil

Diesel Contamination

10/25/2011 10:23 AM



# Spill / Overfill



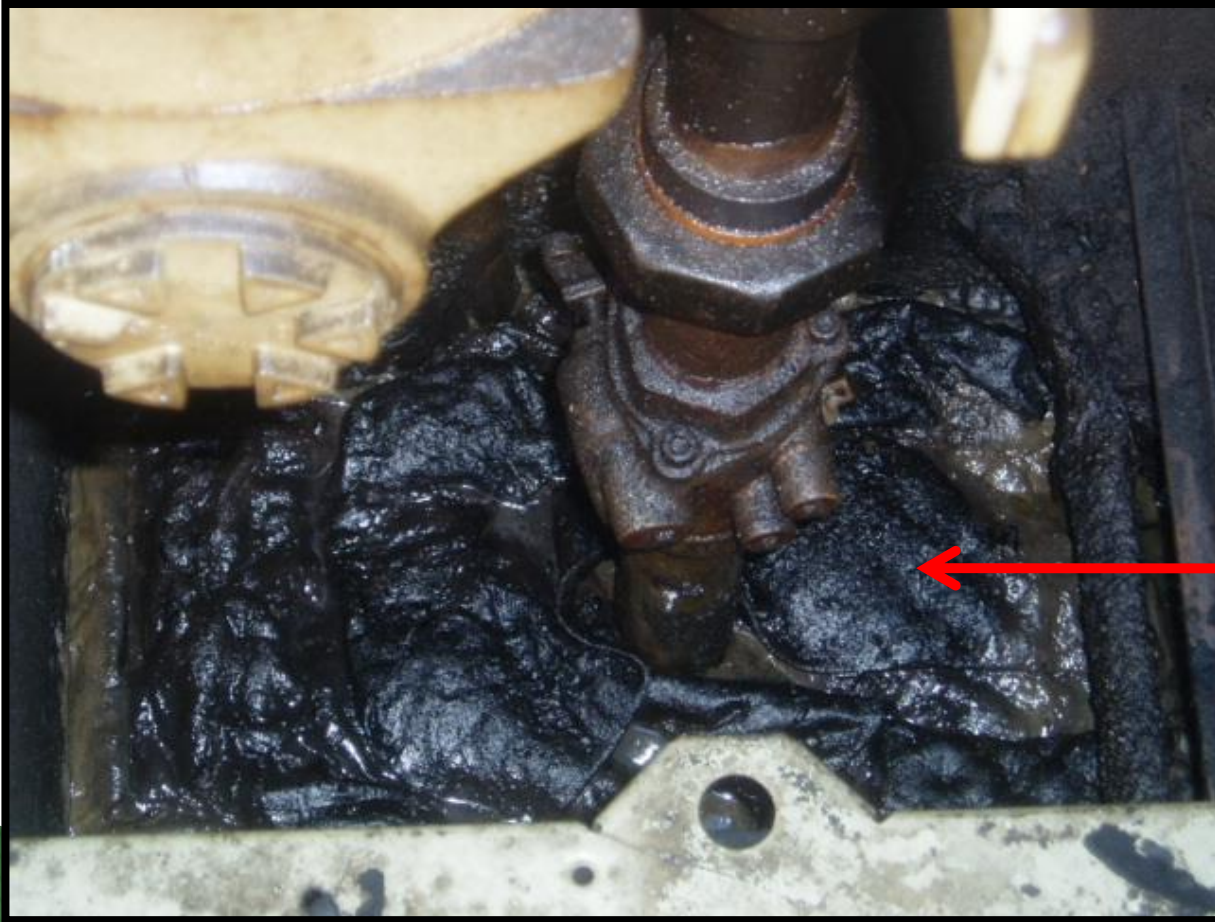
# Operating / Environmental Conditions



Product  
overflowing  
from the  
vapor  
recovery  
tube



# Operating / Environmental Conditions



Sludge  
accumulation  
under  
dispenser

# Operating / Environmental Conditions



Dead Grass  
at fill port



# Suspected Release Response



1. Submit UST-17A form

*‘UST Suspected Release 24 Hour Notice’*


2. Investigate

3. Submit UST-17B form

*‘UST Suspected Release 7 Day Notice’*

# 1. Suspected Release Reporting


- Use UST-17A form
- What indicated the suspected release?

UST-17A UST Suspected Release 24 Hour Notice			
<small>Do <b>not</b> use this form to report a 24 hour notice of a Pollution Incident. You must use form UST-61, 24 Hour Release and UST Leak Reporting Form.</small>			
<small>&gt; This form <b>must</b> be used to report to DENR, within 24 hours of discovery, a Suspected Release from any of the following:</small>			
<small>a) Failed or inconclusive <b>leak detection</b> or <b>tightness test</b> results. This includes positive test results, such as "Increase", which indicates the level in the UST system has increased more than 0.2 gph.</small>			
<small>b) <b>Unusual operating</b> conditions which can include, but are not limited to: the erratic behavior of dispensing equipment; the unexplained presence of water in the tank; the presence of fuel in containment sumps or interstitial spaces; or the degradation of any equipment or element of an underground storage tank system to the point where that equipment or element can not reasonably be expected to perform its intended function.</small>			
<small>c) <b>Internal inspection</b> results such as, perforations, corrosion holes, weld failures, or other similar defects that indicate a release could have occurred.</small>			
<small>&gt; If you have more than four UST systems to report suspected releases, then attach additional sheets of the UST-17A form. You only need to list the UST systems at your site that have suspected releases.</small>			
<small>&gt; Within 7 days of discovery, submit a UST-17B form to document the response activities taken to investigate the suspected release.</small>			
<small>&gt; Please submit this form to: NCDENR/DWM, UST Section 1637 Mail Service Center Raleigh, North Carolina 27699-1637 OR Fax to (919) 733-9413</small>			
<b>I. UST OWNER</b>		<b>II. UST FACILITY</b>	
Name: _____		Facility ID: _____	
Address: _____		Address: _____	
City: _____ State: _____ Zip: _____		City: _____ County: _____	
Person Reporting: _____ Title: _____		Person Reporting: _____ Telephone Number: ( ) _____	
<b>III. UST INFORMATION</b>			
Tank Number / Size: _____		/ _____	
Product Stored: _____		/ _____	
Location and/or source of suspected release (check all that apply):			
<input type="checkbox"/> Tank	<input type="checkbox"/> Tank	<input type="checkbox"/> Tank	<input type="checkbox"/> Tank
<input type="checkbox"/> Piping	<input type="checkbox"/> Piping	<input type="checkbox"/> Piping	<input type="checkbox"/> Piping
<input type="checkbox"/> Tank Sump	<input type="checkbox"/> Tank Sump	<input type="checkbox"/> Tank Sump	<input type="checkbox"/> Tank Sump
<input type="checkbox"/> Dispenser Sump	<input type="checkbox"/> Dispenser Sump	<input type="checkbox"/> Dispenser Sump	<input type="checkbox"/> Dispenser Sump
<input type="checkbox"/> Spill Bucket	<input type="checkbox"/> Spill Bucket	<input type="checkbox"/> Spill Bucket	<input type="checkbox"/> Spill Bucket
<input type="checkbox"/> Internal Inspection	<input type="checkbox"/> Internal Inspection	<input type="checkbox"/> Internal Inspection	<input type="checkbox"/> Internal Inspection
<input type="checkbox"/> Other (Explain in comments)	<input type="checkbox"/> Other (Explain in comments)	<input type="checkbox"/> Other (Explain in comments)	<input type="checkbox"/> Other (Explain in comments)
Leak detection method or other observation that indicates a suspected release (e.g., ATG, SIR, visual contamination, fuel in sump, etc.):			
Failed/inconclusive date or date that leak detection method suspected release discovered:			
<b>IV. COMMENTS</b>			

Tank Number / Size:	/
Product Stored:	
Location and/or source of suspected release: (check all that apply)	<input type="checkbox"/> Tank <input type="checkbox"/> Piping <input type="checkbox"/> Tank Sump <input type="checkbox"/> Dispenser Sump <input type="checkbox"/> Spill Bucket <input type="checkbox"/> Internal Inspection <input type="checkbox"/> Other (Explain in comments)
Leak detection method or other observation that indicates a suspected release. (e.g., ATG, SIR, visual contamination, fuel in sump, etc.):	
Failed/Inconclusive date or date that leak detection method suspected release discovered:	

## 2. Suspected Release Investigation

Methods may include:

- Tank tightness test
  - Line tightness test
  - Site check/soil sampling
  - Meter calibration
  - Hydrostatic test
  - other
- 

# 3. Suspected Release Reporting:

- Use UST-17B
- What was the cause?

UST-17B UST Suspected Release 7 Day Notice	
<p>➤ This form <u>must</u> be used to report to DENR, within 7 days of discovery, the investigation results for a Suspected Release from any of the following:</p> <p>a) Failed or inconclusive <b>leak detection or tightness test</b> results. This includes positive test results, such as "Increase", which indicates the level in the UST system has increased more than 0.2 gph.</p> <p>b) <b>Unusual operating</b> conditions which can include, but are not limited to, the erratic behavior of dispensing equipment, the unexplained presence of water in the tank, the presence of fuel in containment sumps or interstitial spaces, or the degradation of any equipment or element of an underground storage tank system to the point where that equipment or element can not reasonably be expected to perform its intended function.</p> <p>c) <b>Internal inspection</b> results such as, perforations, corrosion holes, weld failures, or other similar defects that indicate a release could have occurred.</p> <p>➤ If you have more than four UST systems to report suspected release investigations, then attach additional sheets of the UST-17B form.</p> <p>➤ Please submit this form along with the supporting documentation to: NCDENR/DWM, UST Section 1637 Mail Service Center Raleigh, North Carolina 27699-1637 OR Fax to (919) 733-9413</p>	
<b>I. UST OWNER</b>	
Name: _____	
Address: _____	
City: _____ State: _____ Zip: _____	
Person Reporting: _____ Title of Person Reporting: _____ Telephone Number: ( ) _____	
<b>II. UST FACILITY</b>	
Name: _____ Facility ID: _____	
Address: _____	
City: _____ State: _____ Zip: _____	
Telephone Number: ( ) _____	
<b>III. INVESTIGATION RESULTS</b>	
Tank Number / Size: _____ / _____	
Product Stored: _____	
Reason for Suspected Release Investigation (Check all that apply):	
<input type="checkbox"/> Data entry error <sup>1</sup>	
<input type="checkbox"/> Dispensing fuel while test is being conducted <sup>2</sup>	
<input type="checkbox"/> Faulty equipment <sup>3</sup>	
<input type="checkbox"/> Incorrect stick or meter reading <sup>1</sup>	
<input type="checkbox"/> Incorrect tank chart <sup>4</sup>	
<input type="checkbox"/> Internal Inspection <sup>5</sup>	
<input type="checkbox"/> Meter not calibrated <sup>6</sup>	
<input type="checkbox"/> Other (Explain in comments) <sup>1</sup>	
<input type="checkbox"/> Tank/Dispenser containment sump contains liquid <sup>7</sup>	
<input type="checkbox"/> Tilted tank <sup>8</sup>	
<input type="checkbox"/> Unknown <sup>1</sup>	

1. Conduct a tank and/or line tightness test and attach the results, along with all of the supporting data sheets for the test method, to this form for submittal. The summary of the test results by itself is not acceptable. If tightness test results are fail, then you must repair or replace your UST system and conduct a site check in accordance with 15A NCAC 2N .0603.

2. Provide sales receipts or other verifiable documentation that shows fuel was being dispensed from the UST during the test.

3. Provide invoices (with a description of the work completed) or other documentation that shows the equipment has been repaired.

4. Correct your leak detection results using the correct tank chart and submit copies with this form.

5. Repair the UST in accordance with the manufacturer's instructions or a national standard (e.g., PEI API 1631) and conduct a site check in accordance with 15A NCAC 2N .0603. If the UST is not repaired, then it must be permanently closed in accordance with the latest version of the UST Sections Guidelines for Tank Closure.

6. Correct your leak detection results using the amount your meter was adjusted following calibration and submit copies of the meter calibration and leak detection results with this form.

7. Conduct a tightness test (e.g., hydrostatic test) of the sump and submit the test result along with this form. If the test results are fail, then you must repair or replace the containment sump and conduct a site check in accordance with 15A NCAC 2N .0603.

8. Submit documentation from your UST equipment contractor explaining how they determined the UST was tilted. Correct your leak detection results using a tank chart adjusted for the tilt and submit with this form.

Tank Number / Size:	/
Product Stored:	
Reason for Suspected Release Investigation (Check all that apply):	<input type="checkbox"/> Data entry error <sup>1</sup>
	<input type="checkbox"/> Dispensing fuel while test is being conducted <sup>2</sup>
	<input type="checkbox"/> Faulty equipment <sup>3</sup>
	<input type="checkbox"/> Incorrect stick or meter reading <sup>1</sup>
	<input type="checkbox"/> Incorrect tank chart <sup>4</sup>
	<input type="checkbox"/> Internal Inspection <sup>5</sup>
	<input type="checkbox"/> Meter not calibrated <sup>6</sup>
	<input type="checkbox"/> Other (Explain in comments) <sup>1</sup>
	<input type="checkbox"/> Tank/Dispenser containment sump contains liquid <sup>7</sup>
	<input type="checkbox"/> Tilted tank <sup>8</sup>
	<input type="checkbox"/> Unknown <sup>1</sup>

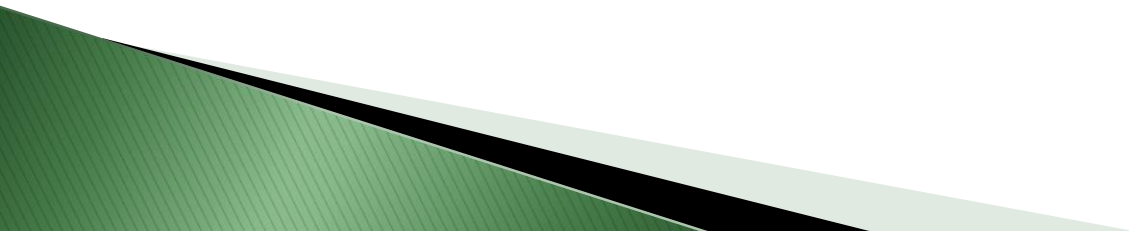
### 3. Suspected Release Reporting:

#### ▶ UST-17B:

- Attach results from investigation
  - Tank and line tightness testing
  - Sales receipts, invoices
  - Corrected leak detection results, etc.



# Confirmed Releases



# Release Confirmed if:

Suspected  
release  
investigation  
finds  
contamination



# Confirmed Release Response:

**Submit UST-61 form  
within 24 hours of discovery**

UST-61		24-Hour Release and UST Leak Reporting Form.	
<b>For Releases in NC</b>		This form should be completed and submitted to the UST Section's regional office following a known or suspected release from an underground storage tank (UST) system. This form is required to be submitted within 24 hours of discovery of a known or suspected release	
<b>(DWM USE ONLY)</b> Incident # _____ Risk (H,I,L,U) _____ Received On _____ Received By _____ Reported by ( <i>circle one</i> ): Phone, Fax or Report Region _____		Suspected Contamination? (Y/N) _____ Confirmed GW Contamination? (Y/N) _____ Confirmed Soil Contamination ?(Y/N) _____ Samples Taken?(Y/N) _____ Free Product? (Y/N) _____ If Yes, State Greatest Thickness _____	Facility ID Number _____ Date Leak Discovered _____ Comm/Non-Commercial? _____ Reg/Non-regulated? _____
<b>INCIDENT DESCRIPTION</b>			
Incident Name: _____			
Address: _____		County: _____	
City/Town: _____	Zip Code: _____	Regional Office ( <i>circle one</i> ): Asheville, Mooresville, Fayetteville, Raleigh, Washington, Wilmington, Winston-Salem	
Latitude (decimal degrees): _____		Longitude (decimal degrees) : _____	
Briefly describe suspected or confirmed release: ( <i>including but not limited to: nature of release, date of release, amount of release, amount of free product present and recovery efforts, initial responses conducted, impacts to receptors</i> )		Obtained by: <input type="checkbox"/> GPS <input type="checkbox"/> Topographic map	

# Confirmed Release Response:

- ▶ Contact your regional office
- ▶ Conduct further action as recommended



# Thank you

Finish Exam (Questions 26–30)

Bring answer sheet to be **graded**

Bring Graded answer sheet to check out

Please turn in:

- Exam questions
  - Envelope
  - Course Evaluation
  - Pencil
- 